ELECTRICAL REVIEW

FRIDAY
OCTOBER 1959

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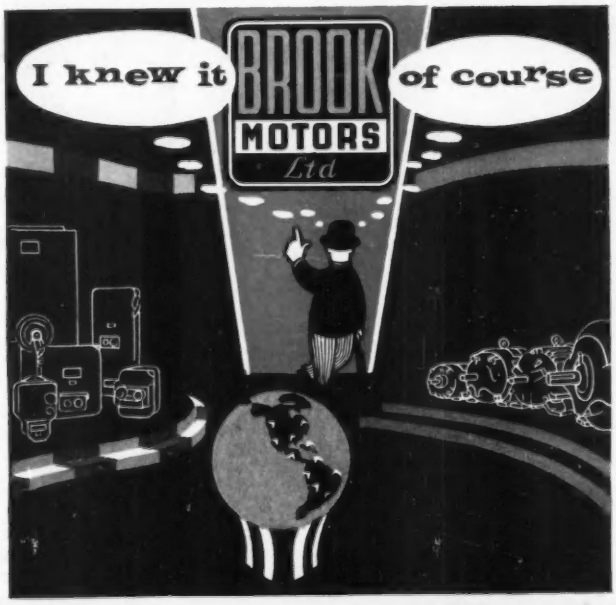

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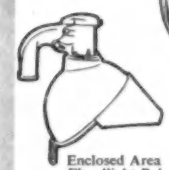

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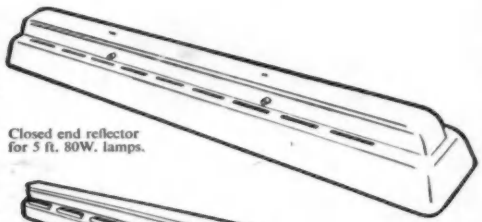

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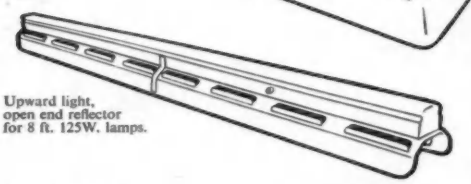

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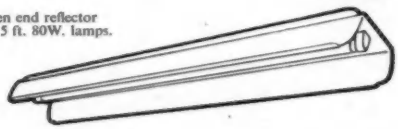

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ELECTRICAL REVIEW

4 December 1959 Vol. 165 No. 17 Established 1872

Railway Electrification Progress

AN important stage in the development of railway electrification in this country was reached last week when the first 25 kV 50 c/s a.c. main-line electric locomotive was delivered to British Railways. Within the next five years electrification at 25 kV 50 c/s of the main lines between London, Birmingham, Manchester and Liverpool will be complete and many electric expresses of the type just delivered will be in service. This means a great deal to the electrical industry, not only in terms of orders for equipment, but also in the demand which it will make for electricity. It is unlikely that additional generating plant will have to be installed to cater for full-scale railway electrification although each express train must be backed by about 2·5 MW of generating capacity. In an article included in our special railway electrification issue of 21st May, 1954, Mr. W. B. Noddings, then deputy commercial manager of the British Electricity Authority, showed that the electricity supply system was quite capable of meeting the railways' demands and, in fact, would welcome the extra load. Since then, of course, the generating plant situation has greatly improved.

The choice of 25 kV single-phase power at industrial frequency has raised many new problems in connection with the civil works, signal engineering and the construction of the overhead contact line equipment. This system has been extensively used on main-line railways overseas, but it has not yet been used on the scale intended in this country for the intensive suburban traffic such as arises in and around our great cities. Large numbers of multiple unit train equipments to be used for such duties are now being produced. Some are already in revenue-earning service between Colchester and Clacton and others are under commission for testing and for the training of drivers at Glasgow and on the Manchester-Crewe electrification.

The design of the electrical equipment for the locomotives and motor coaches represents a major technical advance in the technique of railway traction engineering. Many of the components used in the locomotives have had to be specially designed to meet the extremely arduous operating conditions forecast for future British Railways traffic. Because some of the concepts are completely new, a considerable amount of study and

development has been required to produce the equipment now being put into service. Despite these new concepts, however, the individual components inside the locomotives have been well proved in other applications and different forms. The experience gained by British manufacturers in producing the equipment and developing the new techniques will be of great value in their endeavour to sell equipment to overseas railways and will enable them to keep abreast or in advance of foreign competition and thereby maintain their world-wide reputation for efficient, high-quality traction equipment. In a way, the handing over of the new locomotive was like the inauguration of a permanent exhibition, open to all the world, of modern British railway equipment operated by skilled hands and backed by nearly 150 years of experience. During next year's Railway Electrification Conference in this country the work so far completed will be thoroughly examined by overseas delegates.

VEHICLE LIGHTING

The problem of giving road vehicles adequate and efficient lighting, both to indicate their presence and to illuminate the road ahead, has always received much consideration. That some of the recent thought on the subject has been directed toward the added difficulties associated with high-speed motoring is no doubt in part due to the opening of the London-Birmingham motorway. The higher speeds, to which few British drivers are accustomed, call for improved lighting standards and although a full street lighting scheme has been suggested, initially reliance must be placed on the vehicle's own lighting. The manufacturers' present tendency towards higher wattage rear and brake lights, coupled with statutory reflectors, should give adequate rearward indication to overtaking vehicles but the difficulty of giving sufficient dazzle-free forward illumination remains.

In a paper on vehicle headlamp beam control read recently before the Institution of Mechanical Engineers, Mr. K. J. Jones (Joseph Lucas (Electrical), Ltd.) said that good visual conditions for approaching traffic required uniform meeting beam intensities. At present the major beam variation is caused by headlamp aiming errors and a reduction in these would effect a considerable improvement with existing equipment. If this, largely mechanical, difficulty can be overcome, the need may then be established for lower lamp production variations and even better control of the vehicle's electrical system voltage. Tests have shown that a variation of some 3 V can occur using compensated-voltage regulators and 2 V when using current-voltage regulators, dependent on such factors as harness design, connected load and battery condition, with consequent variation in light output which with gas-filled bulbs is proportional to voltage to the power 3·38.

METALS IN REACTORS

One of the most complex problems in the design of nuclear reactors at present relates to forecasting the effects of continuous bombardment of constructional materials by neutrons over varying periods of time. Any experimental approach appears to be ruled out by the cost and time necessary to secure reliable results. In his Thomas Hawksley Lecture, reported elsewhere in this issue, Professor A. H. Cottrell, discussing the damage from irradiation of metals, suggested that modern metallurgical theory should provide a powerful tool for attacking the problems, which would lead to an ability to make qualitatively reliable predictions. His own theory concerning radiation growth in uranium provided an illustration of the value of a technological system of reasoning applied to practical needs.

IMPROVED CHROMIUM PLATING

During the past few years the quality of chromium plating, particularly on motor cars, has received a good deal of criticism. When exposed to the atmosphere, many chromium plated articles show spots of rust rather more quickly than they should. This is not generally due to any inadequate thickness of chromium but, more often, to a too thin coating of nickel under the chromium. Chromium is porous and moisture can pass through it to whatever metal is underneath and if a sufficiently thick coating of nickel is put underneath chromium an excellent and durable finish is provided.

It is encouraging to know that a move has been made to bring about a general upgrading of chromium plating finishes by the publication of a new British Standard on electro-plated coatings of nickel and chromium. The most important change in this revised Standard is a provision for thicker coatings of nickel which are now possible since nickel is more plentiful. Coinciding with the issue of the Standard comes news that a nation-wide labelling scheme is being launched so that buyers of chromium-plated products will be able to tell whether the plating is up to standard. A third development is the introduction of a new measuring instrument which will make it simpler for platers and manufacturers to check that their products comply with the Standard.

E.T.U. AND T.U.C.

With its patience exhausted by what it calls the evasive nature of the replies it has received from the Electrical Trades Union to questions put to that Union's executive council, the General Council of the Trades Union Congress has sent a very outspoken letter on the subject to the rest of the unions affiliated to the T.U.C. The gist of this is given on page 793 of this issue and it will be seen that the General Council is of the opinion that the leaders of the E.T.U. are either unwilling or unable to take action against those who have accused them of malpractices. It is reported that some members of the Council were in favour of suspending the E.T.U. from affiliation with the T.U.C., but probably fears of serious disruption resulting from such treatment of one of the more powerful unions imposed caution and the proposal was ruled out.

The General Council's letter has had some effect. The E.T.U. has publicly stated that there is no truth in the charges against it; but it has also made the strange suggestion that it would be willing to take legal action against its " traducers " if the T.U.C. was prepared to meet the cost. It is doubtful whether this will be considered a satisfactory answer either by the T.U.C. or by a substantial number of the Union's own members.

Industrial Resistance Welding Applications

By R. W. AYERS*

The steady growth of the resistance welding process during the past fifty years has led to its being used for a large number of applications. Some of the more modern uses of this technique are surveyed in this article, including automobile production, railway engineering, the manufacture of aircraft and aero engines and constructional engineering, and in conclusion the author refers to one of the most important recent developments

WHETHER or not the first resistance weld was an accident or the result of careful thought, the result has been the growth during the last half century of an important resistance welding industry, and the effects of the process have proved of much greater magnitude than could possibly have been conceived even twenty years ago. The process is now one of the most important in the engineering field, particularly, of course, in the sheet metal industry, and its impact on industry has been to influence not only manufacture but design. Many articles now being fabricated by the process could not be made in their present form by any other method. Productivity has always been the great attraction in the use of this process, but this was not always accompanied by complete reliability and it was in the main, therefore, not used for highly stressed parts where each weld was depended upon to carry its share of the whole load. Difficulties concerning the electricity supply available also arose when using the larger types of machines. Great progress was being made just before the last war in perfecting the control of these machines and thereby increasing welding efficiency, and the process played an important part in the manufacture of munitions of all kinds. It is also satisfactory to record that practically the whole of the resistance welding equipment used then was designed and produced in this country.

A power-operated 50 kVA spot and stitch welding machine capable of 700 welds per minute

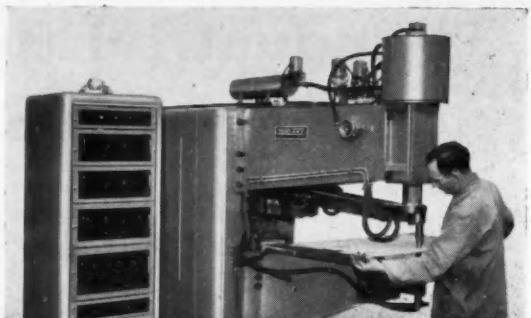
The fundamental difference between gas or arc welding and resistance welding is that in gas or arc welding the two parts to be joined are heated at their junction faces to the molten state, and further metal in the form of a feeder wire or electrode rod is added to join the two parts. In the case of resistance welding the material does not reach the molten state but is heated until the plastic or forging temperature is reached and amalgamation takes place under heavy mechanical pressure. It follows that, as no extraneous materials such as fluxes, filler rods, etc., are used, the metallurgy of the weld is not complicated by the addition of these materials. A spot weld in, say, two thicknesses of $\frac{1}{8}$in light alloy is made in approximately 1/50th of a second or less and considering that in this short period the magnitude of the current is of the order of 200,000 A, and the metal is melted and reformed, the necessity for using electronic equipment to control the current characteristics and timing is obvious. Power operated spot welders of the single-electrode type will produce welds in the thinner gauges of mild steel at a rate of 600 to 700 welds per minute. It is necessary when welding some of the higher tensile light alloys and alloy steels to incorporate a pre-heating or post-heating cycle, and these factors can be incorporated automatically in the design of the machine with the use of electronic controls, requiring no skill on the part of the machine operator. The resistance welding machine is automatic in that it is controlled mechanically and electrically and does not rely on the operator's skill, and it can therefore easily be introduced into an automatic production line.

Motor-Car Production

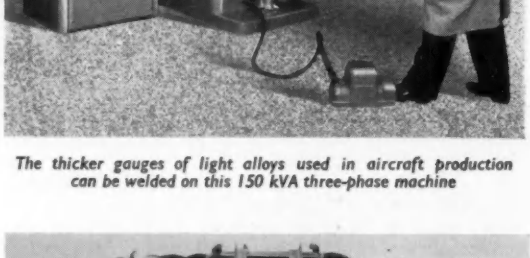
The most important machine in the automobile production field, the portable spot welder, consists of a remote transformer and a gun or welding head which is suspended by conductors and can be moved to any welding position. This enables the different parts of the motor car body assembly to be mounted on a jig or fixture and the operators to move around the stationary fixture and make all the necessary welds. This applies, of course, to any fabrication where it is easier to take the machine to the job than the job to the machine, particularly where the part to be welded must be accurately assembled in a jig or fixture. Portable spot welders can operate at 350 welds per minute and more, while portable seam welders compare favourably with the pedestal type.

* Managing Director, Sciaky Electric Welding Machines, Ltd.

A typical 75 kVA portable spot welder



The thicker gauges of light alloys used in aircraft production can be welded on this 150 kVA three-phase machine



Many of these automobile wheel welding machines are now in use

Multiple electrode machines are becoming more popular, however, and installations are in existence capable of carrying out up to 1,000 spot welds simultaneously. In many cases, however, due to the close proximity of the welds and the varying angles at which they have to be made, it is not possible to utilise one machine for the whole job, and a number of machines and jigs are employed, usually in a straight line, with the transfer jigs or fixtures being moved from one machine to another mechanically. After each machine has completed its welding operation the finished component is ejected. This arrangement is used in the production of complete motor car floors, which are assembled at the rate of 250 an hour with only one or two operators.

Wheel Welding

This arrangement is also used in the assembly of automobile wheels for welding the rim to the centre disc. With the advent of the tubeless tyre, the rim of the wheel becomes part of the air chamber and therefore must be air-tight. Rivets are not always reliable in this respect and spot welding was introduced for this reason alone. Soon it was found that spot welding, using multiple machines, was more economical in time and material; instead of using 12 rivets, eight spot welds are now used and the resultant wheel is considerably stronger than it was formerly. Not only are economies made in time but also in the use of materials and manufacturing machinery. Eventually an automatic machine was used for this operation, taking individual rims and discs from the presses and carrying out on a conveyor the operations of washing, assembly of the two parts by hydraulic pressure, welding, punching, coining and chamfering the valve hole and painting. Production in the order of 1,000 wheels per hour is possible with this type of installation, again with the minimum of operators.

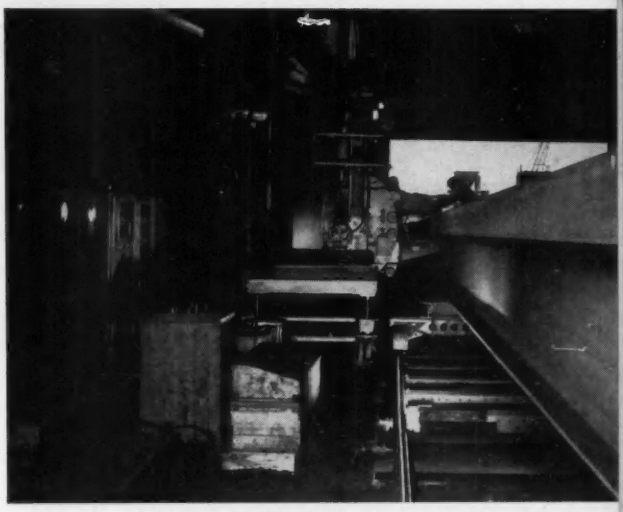
For some years in France and other Continental countries the resistance welding process has been applied to the manufacture of railway carriages, and it has recently been adopted for that purpose in this country. The main problem is to secure flat or slightly curved panels in light gauge steel to stiffeners to form the sides, roof and ends of coaches. From the point of view of appearance rivet heads are not desirable, and in general the fusion welding processes cause considerable distortion in the sheets which becomes particularly noticeable when the coaches are painted. The sides, roofs and ends are therefore assembled as units on a jig by spot welding and afterwards joined to form the coach. The heat from the spot welds is so localised and only takes place for a portion of a second that distortion is prevented. As the passenger coach has a life expectation of many years, it is important that corrosion should be prevented or avoided, and with this object in view different kinds of corrosion-resisting steels are being utilised, calling, in some cases, for both pre-heating as well as post-annealing to avoid cracks in the welds. Some parts are covered with a special paint and spot welded while this is still wet, also as a precaution against corrosion. Another railway application of resistance welding in nearly every

country in the world is the flash welding of short lengths of line *in situ* to form a long continuous rail so providing smoother travelling conditions.

Aircraft Industry

The materials used in the construction of airframes are usually aluminium alloys, duralumins, alclads, etc., and the spot welding of these materials calls for machines with very sensitive controls and high electrical capacity. Despite the difficulties found in the welding of these materials, during and since the war a great deal of production work has been carried out on structures that are generally of a secondary nature, that is, units which are not highly stressed, such as engine cowlings, doors, instrument boxes and internal fittings. Great advances, however, have recently been made in the welding of these alloys and in both America and Europe highly stressed parts such as wings, fuselages, tailplanes, etc., have been assembled by spot welding. Gauges of light alloy material up to $\frac{3}{16}$in plus $\frac{3}{16}$in can be welded, resulting in a streamlined surface free from indentation or protrusion and appreciable reduction in weight and economy of manufacture. A number of the more important aircraft flying in this country at the present time are assembled by this method.

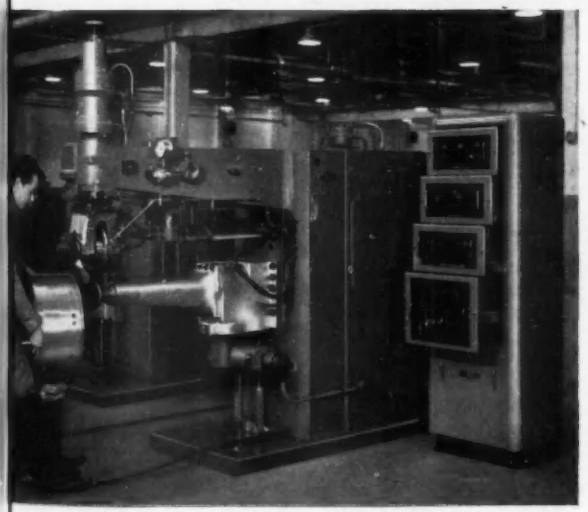
The development of the jet engine gives a good example of a new product being designed largely around the resistance welding process. The materials used in jet engines are high tensile alloys designed to withstand high temperatures, and the stringent standards called for in the welded joints demand special features in the welding machine. Both spot and seam welding are extensively employed in this type of engine, which is largely of sheet metal construction. The more solid parts to which the sheet metal is secured consist mainly of rings of varying sections. Originally these rings were made from forgings and the machining time was lengthy and costly. Using the flash welding process, such articles are now made from straight bar, circled, welded and machined, and an enormous saving in time and money is made in the machining operation. Such a welding operation has been considered commonplace for many years when using mild steel, but the materials in the jet engine are in a different category and again call for an accurately controlled welding machine, heavily built and employing pre-heat and annealing cycles.



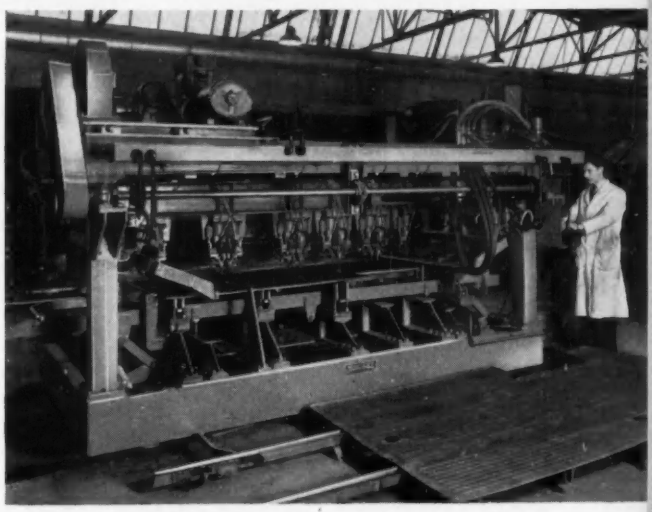
Using a semi-portable spot welder for a heavy constructional engineering application

Constructional Engineering

The field of constructional engineering is one of the last but probably one of the most important to be opened to the spot welding technique, mainly because of the thicknesses of the material to be catered for and the nature of the materials to be welded, the presence of rolling mill scale and the high degree of rust. Again, it is France which is in the vanguard in the use of spot welding in building, and recently a large number of factories have been constructed employing almost wholly spot welded units. The trusses and beam units are spot welded into sub-assemblies in the factory, transported to site and eventually bolted together. The machines for this kind of work can handle a combination of plate thicknesses of 1in plus ½in plus ½in equivalent, and by



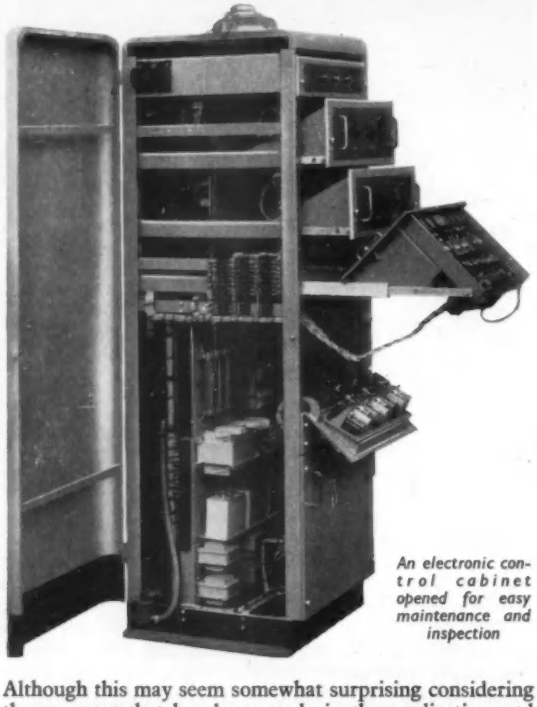
A three-phase machine used in the manufacture of jet engine components



Commercial vehicle floor assemblies are welded on this multiple electrode machine

utilising suitable current and pressure cycles in the machine the necessity for cleaning off the rust and scale is eliminated. This type of machine is relatively costly to manufacture as it embodies very high mechanical pressure and a range of welding currents to first remove the scale and rust and then make the weld and anneal, but it is claimed that a saving of anything up to 30 per cent in labour is achieved in the manufacture of fabricated trusses, etc.

There can be no doubt that the most important recent development in resistance welding is three-phase welding.



An electronic control cabinet opened for easy maintenance and inspection

Although this may seem somewhat surprising considering the progress that has been made in the application and use of resistance welding, the conventional machines have remained practically identical throughout and it is only in the quality of both mechanical, electrical and electronic controls that development has taken place, plus, of course, the application of resistance welding to unusual physical shapes. The author considers that three-phase welding was developed to meet the ever-present difficulty of electrical installation. Conventional resistance welding machines, with the possible exception of a few stored energy types, have always been made for connection between two phases of a three-phase supply, or phase and neutral, and have reproduced a secondary current of sinusoidal waveform. This unbalanced load with its inherently low power factor has always presented difficulties and caused objections from the supply authorities. Finding a solution to this supply and power factor difficulty has led to the creation of three-phase welding, and the advantages which have perhaps fortuitously followed the process have represented the biggest advances made in the industry.

These include improved welding quality, a high degree of automatic compensation for such factors as the change in inductance in the machine due to the amount of ferrous metal inserted between the arms of the machine, more tolerance in the growth of the diameter of the electrode, more control over the shunting of current through the previous spot weld due to the close proximity, and the ability to weld near to the edge of the workpieces. The life of the electrodes between trimming is also considerably increased, largely due to the absence of " skin effect " found in the conventional 50 c/s supply. Three-phase welding has, in fact, revolutionised many jobs that were previously considered borderline cases for spot welding, notably in the heavier gauges of light alloys and also steel, constructional engineering and the delicate heat-resisting materials used in jet engine construction.

The combined advantages to be gained are outstanding, and it would not be surprising if, in the very near future, three-phase machines were the only ones to be considered for major applications. The three-phase principle is equally successful in seam welding and projection welding, and more recently heavy flash welders have been produced in America embodying the system. The only slight drawback to the use of three-phase is that the system is a little more costly to manufacture, and therefore the initial capital cost is higher. This expenditure is, however, compensated for by the reduced cost of installing this type of machine, less installed electrical supply, smaller cables and switchgear, etc., which when added to the advantages quoted above makes the case for three-phase welding unquestionable.

Improving Chromium Plating

A REVISED edition of B.S. 1224 : 1959 " Electroplated Coatings of Nickel and Chromium " has just been published by the British Standards Institution. The main reason for the publication of this revised Standard is to improve the quality of chromium plating by providing for thicker coatings of nickel.

With most plated products it is the layer of nickel rather than the top " flash " of chromium which largely decides the quality and durability of the finish, known as chromium plating. Until recently nickel has been in short supply, but with the end of this shortage there is no longer any reason why an adequate nickel coating should not be applied. A second important change in the Standard is the inclusion of new and more stringent laboratory tests which plated products must be able to pass if compliance with the Standard is claimed for them. In all, nine tests are prescribed in the Standard. They include tests for corrosion in which plating is exposed to the attack of sulphur dioxide or acetic acid and salt; tests to check the thickness of both the nickel and chromium surfaces deposited on an article; and tests to ensure that the plated finish will not easily peel away.

Platers and manufacturers will be glad to learn that in gauging the thickness of the layer of nickel which is called for in the Standard they may now use a non-destructive instrument developed by the British Non-Ferrous Metals Research Association. Hitherto this assessment could only be made by testing a sample to destruction. The Standard still includes such methods but also draws attention to the value of the new instrument for day-to-day control purposes.

Identification of products complying with the Standard will be made possible by a labelling scheme which, in the first instance, is being operated by the Mond Nickel Co., Ltd. This company, working in collaboration with the B.S.I., will supply labels to platers and manufacturers of plated products who must undertake to apply these labels only to plating which complies with B.S. 1224 : 1959. The new Standard calls for three grades of plating depending on the use to which plated products will be put and the labels take this into account. They will be coloured red for " severe " service, blue for " normal " service and green for " mild " service.

Copies of B.S. 1224 : 1959 may be obtained from the British Standards Institution, 2, Park Street, London, W.1, price 5s.

On Friday last Lord Chandos "handed over" the first of twenty-five 25 kV, 50 c/s a.c. main-line electric locomotives to Lord Rusholme, chairman of the London Midland Area Board of British Railways. Twenty-three of these locomotives will be geared for a top speed of 100 m.p.h. while the other two will be capable of running at up to 80 m.p.h.

25 kV 50 c/s a.c. locomotive for British Railways

First High-Voltage A.C. Locomotive

In connection with the modernisation plan for British Railways, the British Thomson-Houston Co., Ltd., now incorporated in the A.E.I. Traction Division, is supplying 25 complete locomotives, the mechanical parts for which have been sub-contracted to the Birmingham Railway Carriage & Wagon Co., of Smethwick, Staffs. They have been designed to the general requirements of the British Transport Commission under the overall direction of Mr. S. B. Warder, chief electrical engineer, and Mr. J. S. Harrison, chief mechanical engineer, British Railways central staff. There will be 23 type "A" locomotives which will be capable of hauling a 475 ton passenger train at 100 m.p.h. or a 950 ton mineral train at 55 m.p.h. There will also be two type "B" locomotives suitable for a top speed of 80 m.p.h.; these locomotives will be capable of hauling mineral trains of 1,250 tons at 55 m.p.h. The principal particulars of the locomotives are as follows:—

	Type A	Type B
Wheel arrangement	Bo-Bo	Bo-Bo
H.p. at one-hour rating of traction motors	3,680	3,680
Top speed—m.p.h.	100	80
Weight—tons	80	80
Max. tractive effort at peak notching current	48,000 lb	60,000 lb
Tractive effort at continuous rating of motors	20,000 lb	24,000 lb
Speed at continuous rating of traction motors	60 m.p.h.	49 m.p.h.

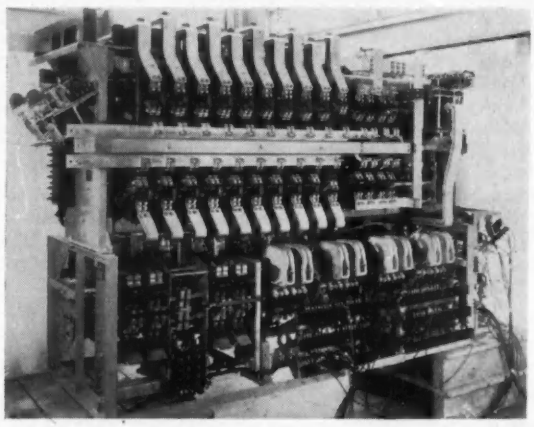
Electrical Features

The locomotive is designed primarily for operation at a line voltage of 25 kV, 50 c/s a.c. However, it has also to develop its full output at 6·25 kV because certain sections of the overhead line have limited electrical clearance under some bridges and tunnels and are fed at this reduced voltage. This is achieved by arranging the main transformer primary winding in four sections, connected in series for a 25 kV supply and in parallel for a 6·25 kV supply. This is effected automatically by an oil-immersed off-load change-over switch controlled by a voltage selector relay.

Current collected from the overhead wire by pantographs of the Stone-Faiveley AMBR pattern is fed through a Brown Boveri air blast circuit-breaker mounted on the roof to the main transformer. The output of the transformer is converted to d.c. for the traction motors by three air-cooled six-anode pumpless steel tank mercury-arc rectifiers, diametrically connected in parallel so that each tank has three anodes in each half-cycle. Load-sharing reactors are provided to ensure current sharing between tanks and individual anodes. Smoothing chokes are also provided.

The four traction motors are connected permanently in parallel. They are six-pole series wound machines specially developed for operation on a rectified 50 c/s single-phase supply. The motors are forced ventilated and designed for long periods of operation between overhauls. This has been achieved by using, among other things, Class H insulation and special lubrication arrangements. The continuous rating of the motors is 847 h.p. (700 A at 975 V), while the one-hour rating is 920 h.p. (760 A at 975 V). The motors are fully spring-borne in the bogies, the drive being transmitted to the road wheels by a quill drive developed from the Alsthom pattern.

A camshaft control unit, actuated by the driver's master



The camshaft control unit provides 37 accelerating notches and two field weakening notches

controller, provides 37 accelerating notches and two field weakening notches. Voltage control is by on-load tap-changing on the low-voltage side of the transformer winding and the output is fed to the rectifiers through two high-speed circuit-breakers, thus rendering anode fuses unnecessary. Besides giving protection against backfires, these breakers are also used as contactors during ordinary locomotive operation and so no individual motor contactors are provided.

Auxiliary Equipment

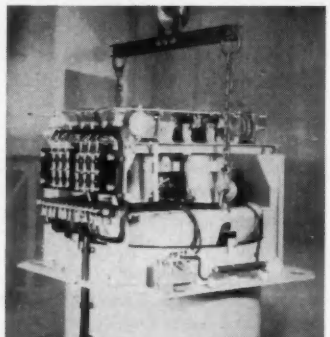
Two traction motor blowers, three rectifier cooling fans, two transformer oil cooling radiator fans and a transformer oil circulating pump are driven by a.c. single-phase capacitor start and run motors. Two exhausters and one compressor are driven by d.c. motors. One exhauster is battery-fed; the other exhauster and the compressor are fed from the a.c. supply through germanium rectifiers. The battery is floating continuously on a magnestat battery charger which also incorporates a germanium rectifier.

Mechanical Features

The locomotive is of the double-ended type and the driving compartments at each end are connected by a corridor. Behind each driving compartment is a space in which are housed the compressor, exhausters and traction motor blowers and other equipment. The central compartment, to which access is obtained by means of an interlocked door at No. 2 end, accommodates the control gear, transformer and rectifiers. The interlocking allows access to the compartment only when the pantographs are lowered and the high-voltage equipment is earthed.

The complete body of the locomotive is designed as a weight-carrying structure which combines lightness with high resistance to buffing shocks and eccentric loading. The maximum use has been made of glass fibre construction for such items as cab roofs, doors, bulkheads, air ducts and even the transformer oil conservator tank.

The bogies are of special interest as the suspension and the flexible drive from the frame-mounted motors utilise the well-known and proved Alsthom principles incorporating rubber bearings and pivots. The traction motors with their gears and quill shafts are carried on three-point pre-loaded rubber mountings in the bogie frames and are coupled to the road wheels by Alsthom type link drives.



Air-cooled six-anode pumpless steel tank mercury-arc rectifier

The wheel sets are carried in double-row spherical roller bearing axle boxes which are connected to the bogie frames by rubber-bushed radius arms giving a cushioned resistance to lateral impacts. The primary coil springs are mounted on equalising beams underslung from the axle boxes in rubber " chevron " mountings and hydraulic dampers are fitted.

The Alsthom type secondary suspension consists of a vertical column between the underframe and bogie fixed bolster with large rubber conical bearings at each end. Tractive effort is transmitted through the rubber, but fore and aft angular movement of the column is controlled by manganese bearing pads while side movement is controlled by pre-loaded double acting springs. The absence of body roll with this type of suspension is particularly noticeable.

NEW REACTOR AT WINFRITH

NEUTRON SOURCE FOR EXPERIMENTAL ASSEMBLIES

THE United Kingdom Atomic Energy Authority has signed a contract with the Hawker Siddeley Nuclear Power Company for the purchase of a reactor to be installed at the Atomic Energy Establishment, Winfrith, Dorset, to be in operation by December, 1960. Contracts for shielding, and other equipment associated with the reactor, are being placed.

The reactor, which will be known as NESTOR, is based upon the company's JASON reactor. Its purpose will be to provide the neutrons required for the experimental assemblies of nuclear fuels and moderators which are used to obtain data for the design of future reactor systems.

To meet the requirements of the Authority the JASON reactor has been modified to be capable of continuous operation at a power of up to 10 kW and its layout has been altered so that it can drive up to five experimental assemblies simultaneously. Details of the modifications have been worked out in collaboration between the U.K.A.E.A. and the company. The reactor is capable of operation at a power level of 10 kW, giving a thermal neutron flux of 10^{11} neutrons/sq cm/sec in the centre of the core and of up to 10^{8} neutrons/sq cm/sec in typical assemblies. The thermal neutron flux can be varied by altering the reactor power level, by using neutron shutters or by rearranging the fuel loading in the annular core.

The nuclear fuel in NESTOR is an alloy of highly enriched uranium and aluminium arranged in an annulus of plates. Natural water is used both as coolant and moderator. The reactor is provided with the usual arrangement of control and safety rods. Additional control may be provided by bubbling nitrogen gas through the water in the annulus or by varying the water level. The experimental assemblies will be placed in " caves " formed in the shielding at the sides and at the top of the reactor. It will be possible to obtain access for experimental purposes to three sides of an assembly whilst it is in position. The cave doors can be opened to change the assemblies and the whole shielding is arranged to be demountable so that the caves can be rebuilt to accommodate major changes in the requirements of the experimental programme.

Automatic Control of Generating Plant

By J. E. O'BREEN, M.I.Mech.E., F.Inst.F., and R. F. HIRSH*

RECENT increases in size of boilers and turbo-generators and the need to operate such sets on a two-shift basis have made it necessary to give serious consideration to the possibility of starting up and closing down both boiler and turbo-generator completely automatically.

It is not many years ago that new sets were kept in operation continuously for months on end and the aim of manufacturers and operators was to extend this period as much as possible. Under those conditions and because sets were much smaller the need for automatic starting and stopping did not exist, and all that the automatic control gear was required to do was to regulate the rate of combustion in relation to the load on the plant. The pneumatic control gear which had been developed, mainly in the decade before the last war, proved to be entirely capable of doing this efficiently.

To start up or close down a boiler requires, however, different equipment and although it might be possible to develop pneumatic control gear for the purpose, there can be no doubt that electronic control gear, combined with computer control, is far more adaptable for the many different functions which have to be carried out in a predetermined way when a set has to be brought on the line or taken off.

It is fortunate that the development of electronic controls and computers has already gone so far and that this equipment can undoubtedly do the work which is required. The same equipment can probably, in combination with pneumatic or hydraulic servo-mechanisms, be used for the combustion control during the period the plant is on load.

Reliability of Equipment

One electronic boiler control installation is already in operation at Little Barford (see *Electrical Review*, 13th November) and others are to be started up soon. The reliability of electronic equipment has already been proved in many other applications, mainly oil refineries, so that from that point of view there is no reason to hesitate in applying computer control to this new function.

It is not the object to describe here in detail the full programme to be carried out from starting up to closing down of a plant, as too many different actions would have to be detailed. A computer is quite capable of seeing to it that such a programme is worked out in the correct sequence, and while doing so of keeping a watchful eye on the continuous scanning of various operating conditions so that it can take the required action if at any time something does not quite happen "according to programme." It will be clear that for the design of such a computer control an exhaustive analysis has to be made of what is required, as well as of the characteristics of the plant.

As already stated, the same control gear will be able to carry out the three different functions, starting up, running on load and closing down, but these functions require the plant to operate in different ways, and it is therefore advisable that when a certain condition has been arrived at, the computer, which is responsible for the starting up, will hand over its principal duty to the normal combustion control, although it can at any time come into operation again to shut the plant down if this is required:—

(a) When during the continuous scanning one or more abnormal operating conditions should make this advisable.

(b) When due to changes in load on the distributing network the set is no longer required. This shutting down could be either decided upon from load conditions or it could be pre-arranged on a time basis.

Designing a Scheme

Before a scheme can be designed, a great deal of information has to be collected from the boiler and turbine manufacturer, as well as from firms supplying auxiliaries used during starting and stopping operations.

One of the difficulties which will be met during this transient period of starting up is the measurement of certain operating conditions, as these determine when the next action in the prefixed sequence has to take place. For instance, the rate of increase of the heat input in the early stages of lighting up will be determined by the rate of increase allowed for the metal temperatures of the superheater tubes and plattens.

Another difficulty during the period when there is practically no load on the boiler is the measurement of flow of the primary and secondary air. Special instruments may have to be designed to measure the very low flow, but control of this air will be impossible if dampers or fan vanes let through in their closed position quantities of air larger than the minimum flow required and special damper designs may therefore be needed.

Measurement of control of the water level in the drum is another point which has to be given special consideration. Until the water in the boiler is getting near boiling point the level should be kept low, as immediately steam bubble formation starts a rise in this level will take place.

When a plant is being started up by hand, similar information should, of course, be available, but in many cases the operating staff uses past experience to decide when the next step in the sequence has to be taken.

Advantages of Automatic Starting

Automatic starting up of a plant which has to run on a two-shift basis will have the advantage that the process can be carried out in a considerably shorter time, and that during this period the efficiency of combustion will be a little higher than with hand control, because when the staff carry out this work by manual control they quite frequently have insufficient data available and therefore have to rely too much on experience, which slows down the process and also results in less accurate fuel/air control.

Automatic starting up will therefore in all probability prove a benefit. Further, it should be more reliable than manual operation, which in view of the large capital involved in the modern boiler plant and the great inconvenience and cost of having a set out of operation if minor accidents happen, would mean greater safety of operation, which would be well worth the additional cost of automatic equipment.

* James Gordon & Co., Ltd. (a member of the Elliott Automation Group).

New Books

Higher Electrical Engineering. By J. Shepherd, A. H. Morton and L. F. Spence. Pp. 566; figs. Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 40s.

This book is a companion volume to " Basic Electrical Engineering " by the same authors, dealt with in the *Electrical Review* last January. It covers matters that usually appear in syllabuses of the Higher National Certificate course and the second and third years of a degree course in electrical engineering.

The ground covered in this volume is very comprehensive and includes circuit theorems and their applications to single- and three-phase circuits, harmonics, transients, electric and magnetic field theory, transformers, synchronous and asynchronous machines, voltage surges, short-circuit calculations and circuit-breakers, and electronics. Nearly a third of the book is devoted to electronics and deals very thoroughly with electron dynamics, voltage and power amplifiers, positive and negative feedback and gas-filled valves and rectifiers.

The text, in general, is very lucidly written and is illustrated by numerous worked examples. The weakest section is that dealing with transformers and machines. Here the statement that the leakage flux of a transformer on no load is about 1 per cent of the useful flux is incorrect, and Fig. 8.7 (a) gives quite a wrong idea of the distribution of the leakage flux. Also, the statement that the voltage regulation of a transformer is often expressed as a percentage of the full-load voltage is not in agreement with the B.S.I. definition. The arrangement of the mush winding in Fig. 9.3 is wrong, and the no-load loss of an induction motor is attributed entirely to the iron loss. In Fig. 16.1 the iron cores of a reactor are shown in such a way as to form a short-circuited secondary.

The text is exceptionally free of typographical errors and the numerous diagrams are very clearly reproduced. Each chapter has a number of problems with answers.

When a book of this type is being compiled, it is always difficult to decide upon the items to be included and those to be omitted. In this case, the authors have made a wise selection; and despite the criticisms made above, which refer mainly to matters of detail, this volume can be recommended to students as a well-written textbook at a reasonable price.—E.H.

Electronic Circuit Theory. By H. J. Zimmerman and S. J. Mason. Pp. 564; figs. John Wiley & Sons, Inc., Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 86s.

The rapid growth of electronics in industrial applications, together with the time limitation of training an engineer, showed the need for a revision of the electrical engineering course at the Massachusetts Institute of Technology. This book is one of a series aimed at a core-curriculum in electrical engineering that will form the basis for a continuing career in an ever-changing field. The text deals mainly with methods of analysis rather than applications of electronic circuits, although gradually design information accumulates from illustrative examples and problems. At the end of each chapter references are given for supplementary reading. The model approach is utilised. A model is a simple ideal, which approximates to the operation of a physical system and therefore is part way between simplicity and reality.

The introductory chapter stresses the fact that, in general, electronic circuits are not linear and do not obey reciprocity. Chapter 2 deals in detail with electrical conduction and diodes as these form the basis for describing the action of transistors, valves and other devices. Following chapters are devoted to resistive diode circuits, rectification and detection, transistors, triodes, control valves, wave shaping, waveform generation, oscillations in RLC circuits, symmetry and balanced circuits. Over fifty pages are concerned with transistors which emphasises the importance of these devices in electronic techniques. Although the progress in this field has been remarkable, the transistor must be considered as complementary to the valve, at any rate for some years ahead. Typical characteristic curves are given for valves and transistors in the appendices. The index is comprehensive and well cross-referenced. This is an ideal textbook for the final years of degree and Higher National Certificate courses in electronics. The departure from the conventional approach of specific applications will no doubt set the pattern for other works of this kind in the future.—J.G.

Progress in Atomic Energy—The Record of the Conference. Vol. I. Pp. 525; figs. Obtainable through booksellers or directly from the United Nations Sales and Circulation Section, New York, N.Y. Price 89s.

The first volume of the proceedings of the United Nations-sponsored second Geneva Conference on the Peaceful Uses of Atomic Energy contains the opening speeches, evening lectures, photographs of the national exhibition and the closing remarks. The training of personnel, the foreseeable future of nuclear science progress, plans for future atomic power projects, administrative problems and cost statistics are discussed by national nuclear authorities. Also included in this volume is a directory of officers, delegates and advisers, containing 2,700 entries.

Compression and Transfer Moulding of Plastics. By J. Butler. Pp. 230; figs. Published for the Plastics Institute by Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 35s.

The monographs in this series have been planned primarily to cover the syllabus in the technology, chemistry, physics and engineering of plastics leading to the Diploma, Graduateship and Associateship of the Plastics Institute; but they will also be found invaluable to anyone who wishes to obtain specialised information on a particular subject connected with plastics. The present volume is the second in the series and is written primarily for students of mould design, for designers and moulding shop executives.

Everything contained in the book's 18 chapters is based on the author's personal knowledge. The book is divided into two parts, compression moulding and transfer moulding, and the contents include mould types, relating mould design to moulding, compression moulding procedures, the evolution of transfer moulding design, feed systems and gate areas, and the effect of transfer on moulding strength.

Models for Training Apprentices

EASTERN ELECTRICITY BOARD'S DEVICES

By J. G. HALL

IN the early stages of apprentice training it is essential that practical work should keep pace with textbook instruction. In the first year it is important that basic principles, without a grasp of which any further instruction is wasted, should be understood and these can best be imprinted on the memory by practical demonstrations. For some time the Eastern Electricity Board has been experimenting with methods of early-stage instruction for apprentices who pass through its apparatus repair department at Wood Green and experience has shown that the pupils learn and appreciate the fundamental facts underlying electrical behaviour and performance best if they can use and then make for themselves certain simple models.

As the superintendent of the apparatus repair department I have produced a series of models which I invite apprentices to copy with as many variants as they wish and can manage and I have found that even with comparatively slow pupils this method of instruction produces excellent results.

When I first decided on models as an aid to instruction, examination of what was available made me realise that few students, however skilful they were with their hands, could approach the accuracy and the finish of commercial products and I therefore decided to make them myself. They were not difficult to construct, but after one or two efforts in which I had tried to achieve a fairly reasonable standard of workmanship, I realised that the cruder the model the better it would serve its purpose. I was dealing with some young men who had absolutely no knowledge of electricity, many of whom regarded an electrical appliance as a magician's box of tricks. I wanted to show that if a basic principle was properly applied, a model could be made from the simplest of materials.

Mr. Hall demonstrates variation in motor performance by altering the field

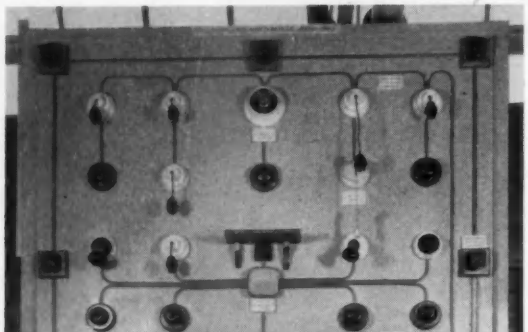
The first model was of a motor. The armature was a rough piece of cork around which had been wound some copper wire and the spindles were two pins. Four other pins stuck diagonally into a wooden base provided the bearings and the commutator was made of two pieces of wire so bent that they made periodic contact with other pieces of wire acting as the brushes. The field was provided by a permanent magnet and the armature energised from two dry cells; I use a second permanent magnet to demonstrate to the apprentices what would happen to the performance of the motor if the field were strengthened. It was a very popular model and variants of it have been made by a succession of apprentices. It drove home better than any other method the magnetic principle that like poles repel and unlike attract, and how, by a simple commutator, rotary motion could be obtained.

Very early in the training of apprentices it is necessary to bring about an understanding of alternating current and to this end I wound a coil of wire around an insulated spindle to which was affixed a handle and which was mounted on a piece of rough wood so that it revolved within the lines of magnetic force of a permanent magnet. Current was picked up from two slip-rings at the end of the spindle, the leads of which were connected to a centre-zero meter. When the handle was turned, of course, the galvanometer needle swung alternately left and right. I supplemented this model with a coloured chart showing two half-circles which represented the surge of alternating current; "a full circle," I impressed upon my pupils, "represents a full cycle in alternating current."

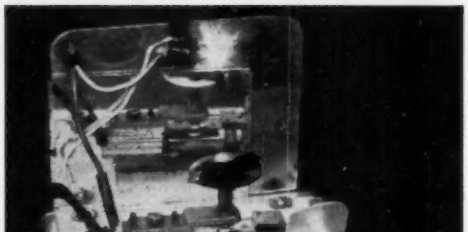
I usually combine this demonstration with another showing the working of a rotary convertor and the synchronising of alternating current. The model for this was developed from a motor which we prepared with two windings on the armature. The first winding operated the motor and the second winding, which was connected to two slip-rings at the other end of the spindle, produced the alternating current. After the demonstration of these two models we rarely had any difficulty about a.c.

Some of the other models which were made were used

Model demonstrating the principle of a.c. being worked by a student apprentice



Students' guide to wiring installations



Operation of a bi-metal strip thermostat by a spirit lamp

not only to demonstrate a principle, but actually to show the working of some standard piece of apparatus. The thermostat is a case in point and the model used not only demonstrates the use made of the bi-metal principle for automatic switching in electrical circuits, but shows precisely how a thermostat works.

A thermostat from a domestic electric iron was so arranged that an indicating lamp—representing the heating element of the iron—was lit from a dry cell via the thermostat contacts. The flame from a small spirit lamp was placed underneath the bi-metal section of the thermostat. The heat from the flame causes a bending action to take place in the bi-metal, the contacts open and the lamp is extinguished. When the flame is withdrawn the bi-metal cools off and the contacts reclose.

At some suitable point in the training, which depends largely upon the personal equation, I demonstrate that when an electric current is present in a circuit the electrons in the wire are in motion and an electroscope, which is not unlike a Leyden jar, was produced to demonstrate this. Another method of demonstrating the passage of electricity through conductors and across the air is given by a shocking coil. This was constructed in the usual way with an iron core, primary and secondary windings, and an armature. The electrode, which was connected to the secondary circuit, was provided with a handle and was brought into contact with one end of a 5ft fluorescent tube so placed that the other end was within an inch or so of the tubular heater in the room. Upon being energised the current flowed through the fluorescent tube and produced a fine display of sparks against the tubular heater; if the electrode was brought into contact with a gas-filled filament lamp the current could be seen as purple flashes discharging in the bulb.

Although not strictly a model I made up two demonstration boards showing typical wiring circuits for the house or shop, one being in conduit and the other in insulated cable. I found these were followed much more easily by the students than by diagrams, even if the latter were of considerable size.

E.D.A. INDUSTRIAL DEVELOPMENT CONFERENCE

THE third Industrial Development Conference organised by the British Electrical Development Association, which was held at the Cairn Hydro, Harrogate, last week, was attended by 120 delegates from Electricity Boards, the Elctricity Council, the Central Electricity Generating Board, and the Belfast Electricity Department.

The Conference opened on Tuesday under the chairmanship of Mr. A. N. Irens, chairman, South Western Board, and chairman of the E.D.A. Industrial Development Committee. Papers were presented by Mr. P. E. Peck (Associated Electrical Industries, Ltd.) on "Electrical Variable Speed Drives," Mr. P. Cahn-Speyer (editor, *Engineers' Digest*) on "Mechanical and Hydraulic Variable-Speed Drives," and Mr. R. H. Wheat (Wm. Don & Partners) on "Eddy Current Couplings."

In the afternoon delegates divided into groups to visit the works of Pilkington Brothers, Ltd., Doncaster; B. S. & W. Whiteley, Ltd., Pool-in-Wharfedale, Yorks.; the English Electric Co., Ltd., Bradford; and Montague Burton, Ltd., Leeds. Wednesday was devoted to visiting the premises of the Darlington Wire Mills, Ltd., Darlington; Patons & Baldwins, Ltd., Darlington; Rolf Spark & Sons, Ltd., Stockton-on-Tees; F. Hill & Sons, Ltd., Stockton-on-Tees; the South Durham Steel & Iron Co., Ltd., Stockton-on-Tees; Imperial Chemical Industries, Ltd., Wilton Works, near Grangetown; the National Glass Works (York), Ltd., York; and Rowntree & Co., Ltd., York.

Thursday morning's proceedings were presided over by Mr. W. N. C. Clinch, controller, Eastern Division, C.E.G.B., and immediate past-chairman of the E.D.A. Council. A paper on "Electricity Load Factor" was given by Mr. E. Bates, chief commercial officer, North Eastern Board, after which Messrs. E. M. Ackery and J. T. Sharples (E.D.A.) reported on the Fourth International Congress on Electro-Heat at Stresa. In the afternoon parties of delegates visited Pilkington Brothers, Ltd.; B. S. & W. Whiteley, Ltd.; Montague Burton, Ltd.; and Lister & Co., Ltd., Bradford. In the evening an open forum was held under the chairmanship of Mr. J. I. Bernard, director and secretary, E.D.A.

The chairman at Friday's session was Mr. T. M. Ayres, chairman, North Eastern Board, and a paper on "The Approach to the Industrial Consumer" was given by Mr. J. P. Heslop, North Eastern Board. The proceedings concluded with the Conference dinner at which Mr. T. E. Daniel, chairman, North Western Board, and chairman of the E.D.A. Council, presided.

OIL REFINERY INSTRUMENTATION

British Equipment for German Installation

A LARGE control panel and desk to be installed at the Dinslaken Oil Refinery being constructed by the Kellogg International Corporation for the B.P. Benzin and Petroleum Aktiengesellschaft in Germany was on show last week at the Chiswick works of the manufacturers, Evershed & Vignoles, Ltd. The instrumentation and control equipment at the refinery, which will initially cover 300 acres and is designed for a daily throughput of 100,000 barrels, is applied to two crude distillation plants, a hydrofiner, a catalytic reformer and a redistillation unit. The whole of the indication and control facilities are terminated at the control desks and cubicle, and 120 separate control loops are provided, some of them being interrelated by re-setting and cascading arrangements. Temperature measurements from 340 different points throughout the refinery, effected by thermocouples and used for indication or control purposes, form part of the installation. There are also two analysis recorders for hydrogen and oxygen.

Recording System

Four quadruplex recorders give selective recording from 64 different points. Each of the recorders' 2in charts may be connected by a standard jack-plug system to any one of four measuring circuits, so that each recorder covers 16 points. The input signal to the potentiometric recorders is derived across a 1 Ω precision resistor inserted into the circuit when required. Selection of temperature measurements is provided by a switching system based on telephone type keyswitch boards mounted on each control desk. The temperature measuring circuits usually consist of a thermocouple feeding a potentiometric recorder via the switchboard. In certain loops, d.c. amplifiers are employed to convert the thermocouple output into a signal for use as a measured value input for a process controller.

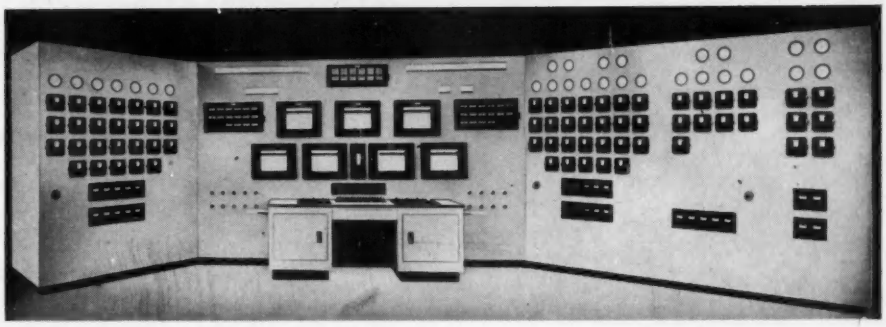
During normal operating conditions in individual sections of the refinery, a "normal operation" window is illuminated on the panel. Alarm conditions automatically extinguish this and provide flashing illumination of an "alarm condition" window.

Rapid supervision of the more important plant parameters is provided by Evershed "In-Line Scanners." These are essentially moving coil indicators permanently inserted in the control loops. They present an unbroken shadow line when conditions in each loop are at the desired value. Any break in the line locates an error condition, together with the direction of the error and some indication of its magnitude.

The output signal of the three-term—proportional, integral and derivative—process controllers operates electro - pneumatic valve positioners or convertors in which an air pressure output is established proportional to the electrical control signal. The controllers embody facilities which allow routine testing without the need for additional equipment. The three thermionic valves and the stabiliser valve incorporated are mounted on a withdrawable plug-in printed circuit board, which may be replaced with the valves without changing the characteristics of the control loop. Indicators are provided for the measured value, desired value and controller output.

In most of the plant mounted transmitters the physical variable to be measured imposes a turning moment on a centre pivoted beam carrying on one end a coil operating in a magnetic field and on the other a contact arranged to travel between two stationary contacts. These are connected to sources of positive and negative bias voltage respectively, transmitted through the centre contact as a result of a beam deflection to the grid of a thermionic valve in a power unit or controller at the central control room. This bias alteration changes the valve current which is fed back to the beam mounted coil, connected in the cathode circuit of the valve. The force produced opposes the turning moment generated by the physical parameter. When the two forces are equal, the beam is centralised and no bias is fed to the valve, the current through the valve and coil being proportional to the physical parameter. Indicators, recorders and other facilities are series connected in the cathode circuit of the valve and calibrated directly in terms of the physical parameter. As a "force balance" principle is employed, the system automatically compensates for changes in transmission line resistance, additions to indicating or recording facilities, and changes in supply frequency and voltage.

The process controllers receive the measured value signal from a transmitter and generate a proportional voltage signal. A stabilised power source in the controller provides a manually adjustable voltage in the same range representing the desired value. This is connected in opposition to the voltage representing measured value, and any difference, due to a deviation of the process under control from desired conditions, is applied to a proportional amplifier, the output of which forms the proportional term of the controller output signal. The deviation also provides the input to integral and derivative networks and amplifiers, the outputs of which are added to the proportional signal so that a true three-term control signal is generated.



Evershed & Vignoles control panel and desk for the Dinslaken Oil Refinery

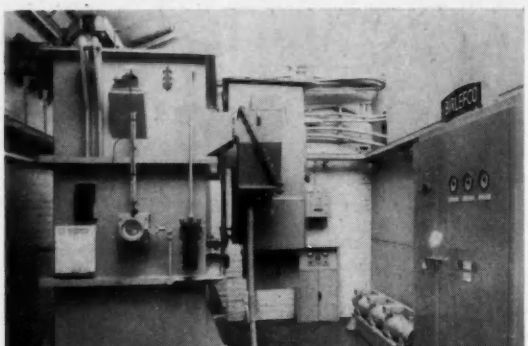
Arc Furnace Installed at Ferranti Factory

PRODUCTION OF PIG IRON FROM RECLAIMED SCRAP STEEL

PIG iron used in the production of cast iron materials by the Foundry Department of Ferranti, Ltd., at Hollinwood, Manchester, will now be obtained from reclaimed scrap steel following the installation of a Birlefco three-ton capacity electric-arc furnace. The scrap to be used consists basically of croppings from transformer laminations and other mild steel. To this material, back scrap from the foundry and recarburising compound will be added to increase the carbon content to 3 or 3½ per cent, and the steel will become cast iron on the addition of silicon and manganese.

The materials to be produced in the new furnace include "Nomag," a non-magnetic grey cast iron; spheroidal graphite iron, a cast iron possessing the equivalent strength of mild steel; "NOduMAG," basically "Nomag" with spheroidal graphite having the same general electrical and non-magnetic properties but with much higher strength; and a flake graphite cast iron with a tensile strength in the region of 17-18 tons p.s.i.

The roof of the arc furnace can be slewed to expose the whole of the furnace chamber, permitting rapid charging. The temperature of the molten metal can be closely controlled, and the absence of combustion products in contact with the metal results in a clean product. The composition of the various types of cast iron produced in the foundry is closely controlled using a Strohlein apparatus, which can determine simultaneously the carbon and sulphur content of a sample obtained from the furnace within five minutes. Samples of S.G. iron are polished, examined under a microscope to determine that the graphite is in spheroidal form, and checked on a Fuess spectroscope for residual magnesium content.



The furnace transformer control cubicle and amplidyne electrode control set are installed in a separate substation

The 1,600 kVA furnace consists of a cylindrical, refractory-lined, bowl-shaped shell of 7ft diameter with three 8in diameter 6ft long electrodes projecting vertically through the removable roof and connected through flexible cables to a furnace transformer. The ring in which the roof refractories are seated is water cooled, as are the electrode arms and clamps. Winch motors and counterbalanced wire ropes are provided for each electrode, controlled by an amplidyne regulator which maintains a constant arc and a high average power input. Metal pouring is simplified by a tilting screw mechanism which can be operated by an electric motor or manually. The furnace tilts up to 45° in the forward position for draining the molten metal and up to 15° backwards for slagging-off. Batch melting takes about 1 to 1½ hr and the furnace is charged by an overhead crane.

Because of the atmospheric conditions in the foundry, the electrical apparatus, including a circuit-breaker, transformer and amplidyne set for electrode control, is housed in an enclosed adjacent substation. This also contains the furnace control panel, but the controls and instruments are mounted on the front of the panel board in the furnace area for easy access by the operator. This control panel is divided into high- and low-voltage sections and is equipped with a Honeywell Brown furnace temperature indicator and Ferranti ammeters, voltmeters, wattmeters and kWh meters.

The three-phase Ferranti furnace transformer is provided with variable reactance both to ensure stable operation of the arc over the wide range of furnace secondary voltages from 230 to 95 V and to limit the short circuit current should an electrode come into direct contact with the metal charge.

The transformer off-load tapping switch is interlocked with the circuit-breaker to ensure that the breaker will be tripped if manual operation of the tapping switch is attempted with the transformer live.

The breaker cannot be closed unless the tapping switch is in an operating position, and the other interlocks provided for the safety of the operator include means to prevent the circuit-breaker being closed unless the furnace roof is in position.

Three-ton 1,600 kVA furnace at the Hollinwood foundry of Ferranti, Ltd.

VIEWS on the NEWS

By REFLECTOR

IN spite of the 24-hour strike early this week the power stations concerned continued to run thanks to the efforts of the stations' salaried staffs. The Electrical Power Engineers' Association pointed out in a Press statement that the Association itself was a trade union and regarded the actions of the "unofficial" strikers as stupid and wrong. It added a touch of humour by mentioning that a spokesman for the strikers had magnanimously stated that he and his friends would not try to prevent the Central Electricity Generating Board from maintaining electricity supplies if they could. The E.P.E.A. says that it is sure "the ten members of the Board, although hard-working public servants, would be the first to admit that to operate personally great power plants in London and elsewhere would be truly a modern labour of Hercules." Some of the members, of course, are quite qualified to take a share in such a task.

* * *

Lighting levels in the United States are on the whole much above our own, but they are still considered to be insufficient—by the lamp makers if by nobody else. The *Electrical World* (New York) reckons that 50 million American homes have 1,175 million sockets, an average of 23·5 sockets per home. It is considered, however, that to be adequately lighted these homes should have 3,000 or 4,000 million sockets; "the average dwelling should have 60 to 80 [lamps], averaging 33 W each." Some of these, of course, would be grouped, but even so a vast amount of wiring seems to be entailed. By our standards this seems to be rather extravagant, but it serves to remind us that our ideas on illumination can do with a little revision.

* * *

An *Evening Standard* reader has noticed that the centre-piece of a window display at a branch of the North Thames Gas Board is "a warm-looking gas fire, giving out a comforting glow." On close inspection, however, it can be seen that this "gas" fire is electrically operated. Tackled on the point, the Gas Board is reported to have said (rather rashly I think):—

> "We have to use electricity for gas fires in window displays because we can't put a gas fire in the window without a flue, it is dangerous."

* * *

Only three of the 140 awards and commendations made under the Civic Trust County Amenity Awards scheme were of an electrical character and one of these was negative. A new street lighting scheme at Haddington, East Lothian, gained a commendation and the Civic Trust says that few street lighting schemes carried out in the last few years have reached such a high standard. An Award was bestowed in respect of part of the Dolgarrog hydro-electric scheme of the Central Electricity Generating Board. "Engineering structures treated as sensitively as this entail no destruction of the countryside." But then the Trust goes on to say:—

> "Unfortunately it will probably be a long time before a line of pylons is likely to receive an Amenity Award, but it would be nice to see one entered for the competition, indicating that careful thought had been given to the route chosen from the amenity aspect."

After this it records that a scheme for the *removal* of overhead l.v. lines at Petersfield, Hants, wins an Award.

* * *

Criticising the boards which are running the nationalised industries, Mr. R. H. S. Crossman, M.P., said last week that

> "the nationalised board, which is neither a public enterprise responsible to Parliament nor yet an efficient profit-making monopoly, is a monstrous hybrid, neither fish nor fowl. It can be got to work fairly satisfactorily in certain public services such as electricity, but it has no relevance to productive industry."

Mr. Crossman must be thanked for his almost-kind reference to electricity, but surely that industry is productive, even if its "product" is intangible. I will let the gas people answer for themselves.

* * *

Some importance is attached nowadays to the use of electricity in agriculture which is sometimes treated as though it were a recent development. Yet sixty years ago the *Electrical Review* (1st December, 1899) reported a German enterprise in the following terms:—

> "An association of farmers in the district of Ochsenfurt (Bavaria) is erecting large electrical works near the village of Butthard, in Lower Franconia, which will be entirely devoted to agricultural uses. The current is produced close to the village of Schaftersheim, a distance of 11 kilometres, requiring for its creation a force of about 150 h.p., which is supplied partly by steam and partly by water, and conducted as current of 5,000 volts to the villages of Butthard, Laudenbach and others, where it finds the most varied use. Movable electro-motors for driving thrashing machines, chaff cutters, bruising mills, etc., are supplied, and connecting boards for the conducting wires are placed at every farm. The motors are of very simple construction, and can be easily handled by any of the farm hands. The electric light will be widely used in all the villages named, and on account of greater security with regard to fire in the lighting of agricultural buildings it is daily increasing in use among farmers."

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Supply Industry Finances

REFERRING to Mr. D. J. Bolton's article under the above heading in the *Electrical Review* of 20th November, I do not agree that "the only way of finding whether the tariff as a whole has risen or fallen is to examine the overall price per kWh at one given coal price." The fuel adjustment charge has decreased over the years taken for comparison and I suggest that to get an accurate comparison of bulk supply purchase cost this should be based on the cost of fuel for 1958-59 and the load factor for that year, these being 79s 5d/ton and 47·2 per cent respectively. By limiting the calculation to 60s fuel the figures do not give the benefit of the 19s 5d increase above 60s at 0·00055d/1d adjustment as opposed to 0·0007d/1d in 1952-53 and that is important.

For the year 1958-59, the fuel cost was 79s 5d per ton and load factor 47·2 per cent for all Area Boards combined. On these conditions the present bulk supply tariff, applied as from 1st April, 1959, compares with that for the year 1952-53 as follows:—

Per kWh Purchased

1952–53		1959–60	
kW Demand @ 85/6	0·248d	kW Demand @ 142s	0·412d
kWh @ 38s fuel	0·330d	kWh @ 60s fuel	0·410d
At 79s 5d fuel add		At 79s 5d fuel add	
41s 5d @ 0·0007d/1d	0·348d	19s 5d @ 0·00055d/1d	0·128d
Total	0·926d	Total	0·950d

On equivalent basic conditions the rise is only 0·024d or 2·6 per cent and a substantial portion of this, it would appear, is accounted for by the higher depreciation assessment basis now adopted and when taking account of the difference in net surplus I arrive at a figure of increase of about 1·25 per cent which seems a very creditable performance. This conclusion appears to conflict with Mr. Bolton's findings.

As to the graph, Fig. 2, I am not at all clear as to how the figures are arrived at. Taking the London Board as an example, the distribution cost for 1958-59 is given as 0·81d. Statement 7 of the Board's report and accounts gives a purchase cost of 1·3244d per kWh sold, the addition of these two figures being 2·1344d, whereas the sales income was 2·018d per kWh. The result would be a deficit whereas there was a surplus, before transfer to reserves, of £3·63 million.

A comparison of the London Board's report and accounts for 1958-59, statements 3 and 7, with those of 1953-54 discloses the following:—

Per kWh Sold	1953–54	1958–59
Revenue Expenditure (statement 7)	1·7502d	1·8758d
Purchase of Electricity "	1·1210d	1·3244d
Distribution Cost	0·6292d	0·5514d
Add Interest and Financing as Statement 3	0·0650d	0·0700d
Total	0·6942d	0·6214d

These figures are in conflict with the higher figures of Fig. 2 and the latter show a lower percentage drop. My calculations for the Eastern Board, as a further example, disclose a drop in cost of distribution over the years as opposed to a substantial increase as Fig. 2 and similarly substantially lower cost per kWh. Others I have not calculated and perhaps Mr. Bolton would indicate the basis on which his calculations were made. The London Board's selling price was 2·018d and purchase price 1·3244d in 1958-59, a difference of 0·6936d, whereas the graph gives 0·81d and the latter is intended to be selling price less purchase cost per kWh sold.

Birdham, nr. Chichester. E. W. DOREY.

"Keeping the Pot Boiling"

I SHOULD like to add to Mr. Cameron Brown's "Pot Boiling" letter in your 20th November issue. The device to which he refers—but tactfully does not name—sounds very similar to the "Simmerstat" made by this company for many years for use with cooker boiling plates and grills. Mr. Brown may like to know that he can now purchase this unit already fitted with either a 13 A or 15 A plug and complete with cable entry for his kettle lead.

This device, the "Reguplug," can also be used with domestic irons, soldering irons or any other form of electrical heating appliance.

London, W.C.2.

J. F. HAYES,
Press Officer,
Sunvic Controls, Ltd.

Electrical Floor Heating Conference

A ONE-DAY conference on electrical floor heating held recently by the Royal Institute of British Architects was well attended by architects, builders, Electricity Board personnel, heating engineers and members of the Electrical Floor Warming Association. The main interest in the contribution from Mr. Dick of the Building Research Station lay in his estimation of the radiant and convection output from warm floors, which he considered to be 40 and 60 per cent respectively. He thought that a ceiling panel must be more radiant than a floor panel since the air it warmed could not rise, the convection that did occur being caused by the cooling of air in contact with outside walls, windows, etc. Mr. Cox, an architect with the London County Council, displayed and discussed data relating to the application of the various methods of space heating to domestic premises. He estimated that power for electrical floor heating in domestic premises required to be purchased at about 0·8d per kWh to be competitive.

A member of the Invisible Panel Warming Association, Mr. H. H. Bruce, thought that many of the problems affecting domestic premises could be solved by the architects themselves. He displayed a typical floor plan for a block of flats and pointed out that most of the living rooms had maximum exposure while other rooms were comparatively sheltered, although in most domestic applications it was the living room which was floor-warmed, plus either the hall or kitchen. He suggested that neighbouring living rooms should be arranged together leaving the exposed positions for the unheated rooms. This would reduce heat losses and running costs for the living rooms and also reduce the output requirements from the floor to a level more commensurate with the low output characteristics of warmed floor surfaces.

Electrical Power Engineers

THE 32nd annual dinner of the Electrical Power Engineers' Association was held last Friday at the Connaught Rooms, London, when nearly 500 members and guests were present. The chairman, Mr. R. Johnson, M.I.Mar.E., M.Inst.F., president of the E.P.E.A. (superintendent, Clyde's Mill power station), and his distinguished guests were led to their seats at the top table by a piper in Highland dress. The loyal toast was proposed by the chairman and as the toast list had been reduced to only one other item, Mr. Johnson then welcomed the guests and referred in particular to Sir Henry Self, Mr. C. R. King, Sir John Pickles and Sir Christopher Hinton, the last of whom proposed a toast to the Association.

During his speech, Sir Christopher said that he would hate to calculate the tonnage of paper which passed through his office every day. Although only a small proportion of this paper appeared on his desk, he tried to find time to read the Association's periodical. He found that he often appeared in it himself and had been referred to as a newcomer to the industry, but he was trying to wear off this newness. Engineering was both the best and worst of all professions. It was the best because it gave a breadth of interest, achievement, service and fellowship not offered by any other industry. It could become the worst of all professions if a good engineer who became a success was no longer allowed to practise engineering. Sir Christopher remarked that this had happened to him and he was envious of those who were still active in the design and construction work of the supply industry. However, engineers at all levels were included in the membership of the E.P.E.A. and he liked to think of the E.P.E.A. as an association of fellowship upon which the service of this great industry rested.

In reply, Mr. Johnson said that many people felt that trade unions were an irritant, but associations of this kind were better than any individual activity. Mr. Johnson referred to Sir Christopher's work in the nuclear energy field and was happy that it had been directed towards pursuing peaceful objects.

After a short interval for clearing the hall, the rest of the evening was devoted to renewing acquaintanceships and to dancing, which naturally had a Scottish flavour.

1. Mrs. D. B. Irving and Mr. D. B. Irving (chairman, London Electricity Board). 2. Mr. H. J. Fraser (vice-president, E.P.E.A.), Mrs. H. J. Fraser, Mrs. H. Brockelsby and Mr. H. Brockelsby (president-elect, E.P.E.A.). 3. Lady Hinton and Sir Christopher Hinton (chairman, C.E.G.B.). 4. Mr. C. R. King (chairman, Electricity Council), Mrs. F. H. S. Brown and Mr. F. H. S. Brown (member, C.E.G.B.). 5. Mr. C. T. Melling (member, Electricity Council) and Mr. C. R. King. 6. Sir John Pickles (chairman, South of Scotland Electricity Board), Mr. R. Johnson (president, E.P.E.A.), Mrs. R. Johnson and Sir Henry Self. 7. Mrs. A. M. F. Palmer, Mr. A. M. F. Palmer (editor, "Electrical Power Engineer") and Miss S. Palmer

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Mr. N. A. H. Tomblin has been appointed secretary of the British Electrical Power Convention in succession to **Mr. J. W. Simpson,** O.B.E., F.C.I.S., who retired from that position on 30th November. Mr. Tomblin was educated at King's College, Wimbledon, and Pelham

Mr. N. A. H. Tomblin

Mr. J. W. Simpson

School. He joined Edmundsons Electricity Corporation, Ltd., in 1934, but his service was interrupted by the war, during which (1939-45) he was in the Army. He became chief assistant to Mr. Simpson in 1949.

Mr. Simpson, after 23 years in local government service, latterly as a town clerk, became secretary of the former Incorporated Municipal Electrical Association in 1929 and was well known as the organiser of that Association's annual conventions. He also initiated the *I.M.E.A. Journal* and remained editor until the dissolution of the Association upon the nationalisation of electricity supply in 1948. Then he continued as editor of the journal of the central authority until this year. When it was decided to reconstitute the I.M.E.A. Convention as an all-industry British Electrical Power Convention it was natural that Mr. Simpson should have been asked to remain as secretary.

During the last war Mr. Simpson served as secretary to the National Gas and Electricity Joint Committee and the Electricity Supply Joint Committee and he was joint author of two works on electricity supply statutes, regulations and orders. He was appointed an O.B.E. in 1948 for his work in the electrical industry. Mr. Simpson's address is 33, Shaw Crescent, Sanderstead, Surrey.

Mr. D. C. Lorkin, F.C.I.S., who, since August, 1958, has been carrying out the responsibilities of managing director of Lancashire Dynamo Holdings, Ltd., chairman and managing director of Lancashire Dynamo & Crypto, Ltd., and chairman of Crypto, Ltd., and Dynamo & Motor Repairs, Ltd., has, at his own request, relinquished the position of managing director of Lancashire Dynamo Holdings, Ltd., to enable him to concentrate on his remaining activities. **Lt.-Col. G. S. Marston,** D.S.O., M.C., chairman of Lancashire Dynamo Holdings, Ltd., has accepted the additional responsibility of managing director of Lancashire Dynamo Holdings, Ltd., and will, for the time being, operate as chairman and managing director of the Group.

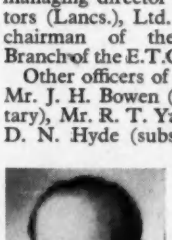
Mr. T. B. Ellis has been appointed secretary of the General Electric Co., Ltd. He takes over from **Mr. T. B. O. Kerr,** who, as we have reported, has been appointed director for finance and administration. Mr. Ellis joined the G.E.C. in 1949 as a trainee, and on completion of his training he went on to Mr. Kerr's staff as his personal assistant. In 1956 he was appointed assistant secretary of the company. Before joining the company, Mr. Ellis was a regular officer serving with the King's Shropshire Light Infantry. He was educated at Repton. During the last war he was in the Dunkirk evacuation, and later was twice wounded during the fighting in France and Germany. He served in Germany and the Sudan after the war before retiring from the Army in 1948 with the rank of major.

At the recent annual general meeting of the Electrical Trades' Commercial Travellers' Association, held in London, **Mr. L. S. Hargreaves,** I.S.M.A., was installed as president for the ensuing year by Mr. W. J. Bird, the outgoing president, and **Mr. R. H. Corlett** was elected chairman.

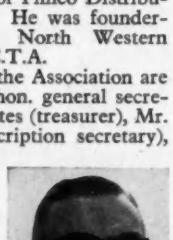
Mr. Hargreaves is founder, managing director and chairman of Aerialite, Ltd., and is also chairman of Nettle Accessories, Ltd., and Television Advertising, Ltd.

Mr. Corlett is managing director of Hardman & Co., Ltd., which he joined thirty years ago, and he is also managing director of Philco Distributors (Lancs.), Ltd. He was founder-chairman of the North Western Branch of the E.T.C.T.A.

Other officers of the Association are Mr. J. H. Bowen (hon. general secretary), Mr. R. T. Yates (treasurer), Mr. D. N. Hyde (subscription secretary), Mr. F. J. E. Simons (social secretary), Mr. A. J. Murray (employment secretary) and Mr. E. R. Stickley (press steward).



Mr. L. S. Hargreaves

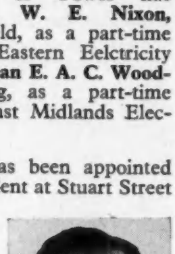


Mr. R. H. Corlett

Sir Ronald Prain, O.B.E., Hon. M.I.M.M., chairman and president of the Rhodesian Selection Trust, Ltd., has been elected president of the Institute of Metals for 1960-61, and **Mr. H. M. Finniston,** B.Sc., Ph.D., A.R.T.C., F.I.M., research manager, C. A. Parsons & Sons, Ltd., and **Mr. H. W. Hignett,** B.Sc.(Eng.), F.R.I.C., F.I.M., M.I.W., assistant managing director, Henry Wiggin & Co., Ltd., have been elected vice-presidents.

The Minister of Power has re-appointed **Mr. W. E. Nixon,** F.C.I.S., of Hatfield, as a part-time member of the Eastern Eelctricity Board, and **Alderman E. A. C. Woodcock,** of Kettering, as a part-time member of the East Midlands Electricity Board.

Mr. K. Ford has been appointed station superintendent at Stuart Street power station, Manchester, of the North West, Merseyside and North Wales Region of the C.E.G.B. Mr. Ford served his apprenticeship with the Metropolitan - Vickers Electrical Co., Ltd., and for seven years was a senior distribution engineer with the North Eastern Electric Supply Co., Newcastle. Since 1945 he has been with the Nottingham Electricity Department, the Ferrybridge power station, Yorkshire, and in 1950 he was appointed deputy superintendent at Chadderton. He succeeds **Mr. J. W. Steeley,** A.M.I.E.E., A.M.I.Mech.E., A.M.Inst.F., who recently took over the position of station superintendent at Agecroft.



Mr. K. Ford

The **E.I.B.A. (Sussex Centre)** is holding its annual ball at the Grand Hotel, Brighton, on Friday, 29th January. Tickets (32s 6d each) can be obtained from the hon. secretary, Mr. T. H. Batchelor, 10, Queen's Gardens, Hove, 3, Sussex (telephone: Hove 39211).

The Plessey Co., Ltd., announces that the Amar Tool & Gauge Co., Ltd., of Chadwell Heath, Essex, is to be grouped for administrative purposes with the Industrial Hydraulics Division and the Sheet Metal Division at Cheney Manor, Swindon, under the

overall management of **Mr. E. H. Y. Burden,** M.I.Prod.E., who joined the Plessey Co. as machine tool adviser in 1956, subsequently becoming general manager of the Amar Tool & Gauge Co. **Mr. R. E. Verguson,** M.S.M.A., has been appointed as commercial manager of the new grouping.

Dr. D. W. Davison, F.Inst.P., F.I.M., has been transferred to the central personnel executive staff at the head office of the Plessey Co., Ltd., Ilford, to assist the personnel director with scientific and technical appointments throughout the company and its associates.

Mr. R. W. Ayers, who writes in this issue on "Industrial Resistance Welding Applications," has been with Sciaky Electric Welding Machines, Ltd., for 25 years, for the last 14 years as managing director. He is also chairman of Xenit Products, Ltd., and of Blandy & Isbill, Ltd. Mr. Ayers is a member of the Institute of Welding and has been chairman of the Engineering Marine Welding and Nuclear Energy Exhibition, and of the International Welding Institute and I.S.O. He is a member of a number of committees of B.E.A.M.A.

Mr. R. W. Ayers

On 28th November **Mr. S. Roberts,** managing director of Hoover, Ltd., accompanied by **Mr. V. C. Mumford,** general sales manager (export), left for South Africa for discussions on the development of the business in that country with Mr. H. Wilcock, general manager of the Hoover Co. in South Africa, and with leading Hoover distributors. Mr. Roberts is due back in England on 20th December.

A son was born on 26th November to Mrs. de Ferranti, the wife of **Mr. Sebastian Z. de Ferranti,** managing director of Ferranti, Ltd. They already have a daughter.

Over 160 employees of the Ekco organisation (**E. K. Cole, Ltd.**), who have completed twenty-five years' or more service with the company, recently formed their own club, known as the Ekco "25" Club. At the inaugural dinner at Garons Banqueting Hall, Southend, last week Mr. and Mrs. E. K. Cole received nearly 200 members and wives.

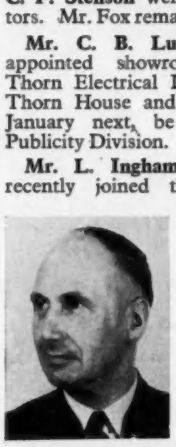
The annual dinner and dance of the North-West London Branch of the **Association of Supervising Electrical Engineers** was held at the Century Hotel, Wembley Park, Middx., on 20th November. Over 120 members and guests were present, and the guests of honour were Mr. A. G. Ramsey, a past-president of the Association, and Mrs. Ramsey, and Mr. E. A. Bromfield, general secretary of the Association, and Mrs. Bromfield. In proposing the toast to the North-West London Branch, Mr. Ramsey recalled that his first acquaintance with the aims and activities of the Association was gained through the Branch. He paid tribute to the position which the Branch had won for itself within the Association. The Branch chairman, Mr. T. G. Murray, responding, mentioned that the first A.S.E.E. Exhibition had been organised by the North-West London Branch; the Branch was holding a "Founders' Day" next year to mark its tenth anniversary. Mr. E. H. Maddox, vice-chairman of the Branch, proposed the toast to the ladies and Mrs. P. A. Thorogood responded.

A.S.E.E. North-West London Branch dinner-dance. Left to right: Mr. R. A. Hope (branch secretary), Mrs. Hope, Mr. A. G. Ramsey (past-president of the Association), Mrs. Ramsey, Mr. T. G. Murray (branch chairman), Mrs. Murray, Mrs. Bromfield and Mr. E. A. Bromfield (general secretary, A.S.E.E.)

Mr. C. J. Fox, chairman and managing director of W. J. Furse & Co. (Manchester), Ltd., resigned at a meeting of directors on 17th November. Resignations were also received from **Mr. A. Keith** and **Mr. B. H. Woodall. Mr. J. K. Furse,** son of the late Mr. W. F. Furse, who, with Mr. Fox, formed the company in 1919, was appointed managing director and **Mr. P. Hoyle, Mr. J. H. Duus** and **Mr. C. F. Stenson** were appointed directors. Mr. Fox remains on the board.

Mr. C. B. Lussignea has been appointed showroom manager of Thorn Electrical Industries, Ltd., at Thorn House and will, as from 1st January next, be attached to the Publicity Division.

Mr. L. Ingham, A.M.I.E.E., has recently joined the Electric Construction Co., Ltd., for sales development in the London and Southern Counties area. He will be at the company's London offices at Bushbury House, 57, Buckingham Gate, London, S.W.1. Mr. Ingham has had experience with the Chloride Electrical Storage Co., Ltd., the Metropolitan-Vickers Electrical Co., Ltd., and the Lancashire Electric Power Co. After naval service in the last war he rejoined the Chloride Electrical Storage Co. on sales development, becoming assistant general sales manager.



Mr. L. Ingham

Mr. W. Ford is to move to the Swansea sales office of Brook Motors, Ltd., on 1st January next as manager. Mr. Ford was a sales engineer at the company's Birmingham office. He has had previous experience of the Swansea area, working there for six years from 1951 to 1957. His place at Birmingham will be taken by **Mr. P. Martin,** previously a sales engineer with the Huddersfield office.

Mr. R. L. Paice has been appointed a director of Brookhirst Igranic (Europe) S.A., one of the European subsidiaries of Metal Industries. For many years Mr. Paice held the position of sales director of Igranic Electric, Bedford. He is now sales consultant to Brookhirst Igranic.

Mr. R. L. Paice

The Board of Trade announces that **Mr. Duncan M. Oppenheim** has accepted the President's invitation to become chairman of the Council of Industrial Design in succession to **Sir Walter Worboys,** B.Sc., D.Ph., who retires on 31st January.

The annual dinner of the **Norfolk Electrical Circle** was held at Norwich on 25th November when Mr. J. A. Sumner, president, in proposing the toast to the City of Norwich, said that he was retiring as manager of the Norfolk Sub-Area of the Eastern Electricity Board in December and he welcomed Mr. W. M. Bishop who is to succeed him. The response was made by Ald. Mrs. M. M. Frazer, Sheriff of Norwich. Mr. T. A. H. Marshall, chief engineer of Anglia Television, proposed the toast of "The Electrical Industry" and said that some makers of television sets produced sets which did not do justice to the work of studio engineers and he asked such firms to rid themselves

of the belief that the public would "swallow anything if it was in the right sort of cabinet." Mr. Bishop responded. The toast of the guests was proposed by Mr. T. L. Wilkes, vice-president of the Circle, to which Mr. R. H. Beeby replied.

OBITUARY

Mr. A. P. MacKim, who died recently at the age of seventy, was with the Glasgow Corporation Electricity Department from 1914 to 1948 when he became planning and development engineer for the Glasgow Area of the South West Scotland Electricity Board. Later that year he was appointed technical engineer at the headquarters of the Board, a position which he held until he retired in 1953.

Mr. D. H. Robinson.—The death occurred on 25th November in London of Mr. Douglas H. Robinson, M.I.E.E., chief electrical engineer to the Sudan Government and late P.W.D., Government of India.

Mr. R. Bolsover, who for many years was technical representative in the London area for Steatite & Porcelain Products, Ltd., has died at Stourport-on-Severn.

National Approvals Scheme

Following discussions over a considerable period, a meeting was held in London last week between representatives of the electricity supply industry, the British Electrical and Allied Manufacturers' Association and the British Standards Institution, together with representatives of the electrical contractors and retailers and wholesalers. At that meeting a Provisional Board of Management of a national organisation for the approval of domestic electrical appliances was formed under the chairmanship of Mr. T. E. Daniel, chairman of the North Western Electricity Board and of the British Electrical Development Association.

This new Board is charged with the setting up as quickly as possible of an organisation to protect and safeguard the British public by approving domestic electrical appliances and by maintaining and publishing a list of appliances so approved. Each such appliance will carry an easily recognisable mark of approval and such approval will be based on a British Standard and will be open to all domestic electrical appliances manufactured in, or imported into, the United Kingdom.

The Board will aim to encourage the general public to purchase only those electrical appliances which have been approved by the organisation and which, therefore, bear the approvals mark. Plans are well advanced and the arrangements for establishing the new organisation and the way in which the scheme will operate will be announced shortly.

Post Office Engineering Appointments

In our last issue we reported the forthcoming retirement, on 31st January, of **Brigadier Sir Lionel Harris,** K.B.E., T.D., M.Sc., F.C.G.I., M.I.E.E., from the position of Engineer-in-Chief of the G.P.O., and the appointment of **Mr. A. H. Mumford,** O.B.E., M.I.E.E., Deputy Engineer-in-Chief, as his successor. **Capt. C. F. Booth,** C.B.E., M.I.E.E., and **Mr. D. A. Barron,** M.Sc., M.I.E.E., Assistant Engineers-in-Chief, become Deputy Engineers-in-Chief on 1st February next. In our previous notice we inadvertently stated that Capt. Booth had been appointed Assistant Engineer-in-Chief.

Brig. Sir Lionel Harris

Capt. C. F. Booth

Mr. D. A. Barron

Brigadier Sir Lionel Harris joined the Post Office Research Branch at Dollis Hill in 1922, having spent four years with Signals in the Australian Imperial Forces and graduated in London University from the City and Guilds Engineering College. He was superintending engineer of the North Midland District of the Post Office on the outbreak of war, when he left to join his Territorial Unit (44th (H.C.) Divisional Signals). After Dunkirk he successively commanded G.H.Q. Signals, was Chief Signal Officer, Lines of Communication; and finally for two years chief of General Eisenhower's Telecommunications Section. After the war he was for four years Director of the Post Office in Scotland, then Controller of Research and finally (in October, 1954) Engineer-in-Chief. During the war he was awarded the Legion of Honour and Croix de Guerre and the Legion of Merit (U.S.); he was knighted in 1957.

Capt. Booth commenced his career with the Post Office in 1923 and was for twenty-five years in the Radio Branch Laboratories of the Post Office Research Station, Dollis Hill. He is an international expert on quartz crystal and primary frequency standards and is part author of a comprehensive textbook on the subject: "Quartz Vibrators and Their Applications." He has represented the Post Office for many years at international conferences as a radio expert and is at present leading the United Kingdom delegation to the International Telecommunications Union Radio Conference in Geneva. In 1952 Capt. Booth was appointed deputy director of the newly set up External Telecommunications Union. He returned to the Engineering Department as Assistant Engineer-in-Chief in 1954. Capt. Booth was chairman of the Radio Section of the Institution of Electrical Engineers for 1950-51.

Mr. Barron was educated at Bristol Grammar School and at the Bristol University. He entered the Post Office Engineering Department as a probationary assistant engineer in 1927 and gained his early experience in the Technical Section of the former South Western Engineering District at Bristol and in Plymouth. He was transferred to the Telephone Branch of the Engineer-in-Chief's Office in 1940 as assistant staff engineer. In 1945 he led a team which went to India to prepare plans for the transfer of the Calcutta telephone service to automatic working. On his return to this country in 1947 he was placed in charge of a working party which examined the problems of subscriber trunk dialling which was introduced in Bristol a year ago. He was appointed Assistant Engineer-in-Chief in 1954.

An outline of Mr. Mumford's career was given in our last issue.

Power Supplies Maintained

Despite the unofficial 24-hour strike of power station workers which began at 10 o'clock on Sunday night, electricity supplies were fully maintained. It had been forecast that 14,000 workers at 33 power stations would join the strike but actually only some 4,000 did so. Eighteen power stations, all but two in the London area, were affected and at these the managerial and technical staffs kept the plant in operation. On Monday night the Central Electricity Generating Board issued a statement thanking the public for their help in economising during the peak period in the late afternoon and referring to the loyalty of the majority of the Board's employees.

Mr. G. Wake, secretary of the unofficial shop stewards' committee which called the strike, against union instructions, said that his committee would meet in Birmingham on 12th December to discuss the workers' demands for longer holidays, a 40-hour week and a wage increase. He thought that the stoppage would have the desired effect and that there would be no need for another, but other steps might be taken.

INDUSTRIAL NEWS

Engineering Wages and Hours

On 24th November the Engineering and Allied Employers' National Federation rejected the claim by the Confederation of Shipbuilding and Engineering Unions for a pay increase of £1 a week. In response to the further claim for a 40-hour week the Employers' Federation offered a reduction from 44 to 42½ hours without loss of pay. The unions expressed their inability to accept this, their representatives contending that the industry was well able to concede the full claim.

In announcing the employers' decision, Mr. B. Macarty, director of the Federation, said that since 1954 the rise in the rate of production had been much slower than the upward movement of wages in the engineering industry. Pointing out that a great deal of overtime was being worked, Mr. Macarty said that a shorter working week would not automatically improve productivity.

The Employers' Federation decided to consult its constituent members on this point while the unions' representatives are to meet on 10th December to consider the position.

Cable Industry Rationalisation

As a further step in the rationalisation of the cable industry, the activities of the Metropolitan Electric Cable & Construction Co., Ltd., are being merged with those of British Insulated Callender's Cables, Ltd., and, from 1st January next, will be transferred progressively from Chadwell Heath, Essex, to Erith Works, Kent. From that date cable manufacture will be undertaken by the B.I.C.C. Power Cables Division and in the United Kingdom the Metropolitan Cable Co.'s sales force will be integrated with the B.I.C.C. home sales organisation.

To the maximum extent, employment will be offered to Metropolitan Cables employees within the B.I.C.C. group and, to those who cannot be so employed, financial compensation based on age and length of service will be paid.

Trading with Russia

Stimulated by the greater interest in trade with Russia following the signature of the Anglo-Soviet Trade Agreement, and the prospect of trade fairs in London and Moscow next year, the London Chamber of Commerce has published a second edition of its excellent booklet "Trading with the Soviet Union" (price 5s). Anglo-Soviet trade, it states, "offers extremely interesting opportunities and the prospect of much greater opportunities in the future." At the same time "special problems exist because of the difference between the trading systems in the two countries." There is, however, no difficulty about language, since "all the State trading corporations in Moscow and the Soviet Trade Delegation in London conduct correspondence and negotiate in English." The total annual volume of trade could easily be doubled during the next five years.

The booklet, which has been entirely rewritten by Mr. R. D. F. Marlow, head of the Chamber's Russian department, gives guidance on methods of trading, export/import licensing, contract terms, patents, advertising and postal and telecommunications services. The appendices include the text of the Anglo-Soviet Trade Agreement, quotas and lists of possible imports and exports and particulars of Russian trading organisations.

Charges Against the E.T.U.

For nearly a year the Trades Union Congress has been endeavouring to obtain from the Electrical Trades Union answers to two questions:—Whether the Union was considering proceedings against certain newspapers which had accused its principal officers of malpractices; and whether it proposed to investigate, or deny, charges that some of the principal officers were associated with a committee set up by the Communist Party to influence or direct union affairs.

In the absence of a satisfactory reply and finding it impossible to arrange a meeting with the full executive of the E.T.U., the T.U.C. General Council circulated a letter to all affiliated unions accusing the E.T.U. of delaying rather than assisting the Council to bring the matter to a conclusion. The Council said that it did not intend to pursue the subject any further but expressed the opinion that the evasive nature of the Union's replies suggested that its leadership was aware that there was so much substance in the charges made that it was unwilling to have them investigated and "unable to specifically and unequivocally deny them."

Replying to the General Council's letter, Mr. F. Haxell, general secretary of the E.T.U., has denied the charges made against the Union. As to legal action against the newspapers which have made these charges, Mr. Haxell says that the E.T.U. is willing to proceed against them if the T.U.C. is prepared to meet the cost.

Lower Import Duty on Machine Tools

From 25th November the import duty on machine tools has been reduced from 17½ per cent to 10 per cent *ad valorem* and the system of refunding duty on individual importations of certain machine tools has been discontinued. Hitherto, remission of duty has been granted where it was established that no comparable machine was procurable in the United Kingdom or was procurable only on an extended delivery. Arrangements for the remission of duty on parts for incorporation in machine tools being manufactured in this country will cease at the end of next year. The rate of duty and arrangements for duty remission on other types of productive machinery remain unchanged.

Trawsfynydd Contract

Bruce Peebles & Co., Ltd., have received a contract valued at over £100,000 from Atomic Power Constructors, Ltd., for a special low frequency electricity supply for motors which will wind control rods in the reactor core of the nuclear power station to be built at Trawsfynydd, North Wales.

Regent Street Christmas Lighting

Regent Street, W., which is always one of London's main attractions during the Christmas season, has excelled itself this year in its festive illuminations. The main showpieces are huge

The Christmas decoration lighting in Regent Street, London

illuminated chandeliers suspended down the centre of the street. These are 25ft high and are in red, green and blue. Suspended across the pavements from the shops are festoons of coloured lamps.

Plant for Brazil

A dollar order valued at about £190,000 has been obtained by the Heavy Plant Division, Rugby, of Associated Electrical Industries for a large turbine-driven centrifugal blower required for a catalytic cracking plant in the new Duque de Caxias Oil Refinery at Rio de Janeiro. The blower will be a three-stage machine, delivering 110,000 cu ft of free air per minute against a discharge pressure of 30 p.s.i.g. and will be driven by an A.E.I. 12,900 b.h.p. condensing turbine supplied with steam at 565 p.s.i.g. and 650°F.

C.E.R.N. Proton-Synchrotron

The European Organisation for Nuclear Research (C.E.R.N.) announces that its proton synchrotron reached its designed output last week for the first time when it produced a beam of protons of an energy of 24,000 MeV. This is the culmination of six years' work of design and construction and the 12 nations of Western Europe who belong to C.E.R.N. now have at their disposal a unique tool for exploration of the inner structure of the atom.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £240 0s 0d
Fire Refined 99·70%	ton £239 0s 0d
Fire Refined 99·50%	ton £238 0s 0d
COPPER Tubes ..	lb 2s 4d
Sheet	ton £270 0s 0d
H.C. wire and strip..	ton £288 5s 0d
LEAD, English ..	ton £71 7s 6d
Foreign	ton £70 0s 0d
MERCURY	flask £71 10s 0d
TIN, block (English) ..	ton £794 0s 0d
ZINC, G.O.B. Foreign	ton £94 5s 0d
BRASS Tubes (solid drawn)	lb 1s 11½d
Wire	lb 2s 8½d
PHOSPHOR BRONZE Wire	lb 4s 1½d
PLATINUM ..	oz £28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 35d—35½d

Bristol Lighting Advisory Centre

Over 100 different types of lighting were on show at Bristol's new Lighting Advisory Centre on 23rd November when it was opened by the Bristol city architect, Mr. A. H. Clarke, who said that the rapid advance in lighting standards owed much to the research and educational work carried out by the British Lighting Council. The new Centre was an important addition to Bristol's amenities and, on behalf of architects, he warmly welcomed it. Mr. W. J. Guscott, chairman of the S.W. Regional Advisory Committee, who is also assistant chief commercial officer (development) of the South Western Electricity Board, introduced Mr. Clarke, and Mr. E. B. Sawyer, secretary of the British Lighting Council, who have sponsored the new Advisory Centre.

Colliery Pumping Equipment for Belgium

Brookhirst Igranic (Europe) S.A. is to supply high voltage pump control equipment to Charbonnages du Gouffre, the Belgian colliery company. The equipment will replace hand-operated gear. Brookhirst Igranic (Europe) S.A., a European subsidiary of the Metal Industries Group, acted as design consultants in drawing up the pumping scheme and obtained the order against strong German competition.

F. T. Jackson Memorial

The November issue of the *T.R. Journal* is dedicated to the life and work of Mr. Fred T. Jackson, O.B.E., chairman of the Telephone Manufacturing Co., Ltd., and Telephone Rentals, Ltd., who recently died. The cover bears a portrait of Mr. Jackson and the journal contains a report of the memorial service held on 26th August; an article by Mr. Campbell Cochrane, "A Plan and its Realisation"; a long illustrated account of Mr. Jackson's activities in connection with his companies; and a series of personal tributes.

Bodmin Telephone Exchange

The second automatic telephone exchange in the country to be equipped with subscriber trunk dialling was officially opened at Bodmin on 25th November by the Assistant Postmaster General, Miss Mervyn Pike. The first exchange so equipped was inaugurated at Bristol by the Queen nearly a year ago. (See *Electrical Review*, 12th December, 1958).

Speaking at the ceremony at the Bodmin exchange, which serves 960 subscribers, Miss Pike said that there were at present some 6,000 telephone exchanges. Of these 5,000 were already automatic and the remainder would be converted within the next ten years, during which time most would be provided with subscriber trunk dialling. She added that, since subscribers to the Bristol Central Exchange had been able to dial their own trunk calls directly, the number of these calls had increased by some 45 per cent.

National Poultry Show

Although the section usually devoted to live poultry exhibits is being omitted because of the fowl pest situation, this year's National Poultry Show at Olympia, London (9th-11th December), will be the largest yet held. In addition to a comprehensive display of appliances and equipment a variety of practical demonstrations are being staged.

B.I.C.C. Further Education Scheme

During the 1958-59 session 171 students from the Prescot and Leigh Works of British Insulated Callender's Cables, Ltd., qualified for awards under the company's further education scheme. Overseas students from India, Pakistan, Chile, Nigeria, Malaya and the West Indies were among those who took part in the scheme. The awards were presented by two directors of B.I.C.C., Mr. C. O. Boyse, at Prescot, and Lt.-Gen. Sir Ronald Scobie, at Leigh.

Commercial Travellers' Benevolent Institution

The annual Court of Governors of the Commercial Travellers' Benevolent Institution will be held on 28th December (12 noon) in the Wax Chandlers' Hall, Gresham Street, E.C.2, and will be followed by a special general court for the adoption of new rules.

Consulting Engineers List

The 1959 list of members of the Association of Consulting Engineers is now available from the Association, 36, Victoria Street, Westminster, London, S.W.1 (price 1s 6d to members and 2s to non-members).

Brushless Alternators for Oil Terminal

Six brushless alternators, each rated at 255 kW, 50 c/s, 1,000 r.p.m., 400/440 V, 319 kVA, 0·8 power factor, are being supplied by the A.E.I. Heavy Plant Division to provide power for ancillary equipment at a deep-water oil-tanker terminal in the Arabian Gulf. The alternators, which will be driven by Davey, Paxman type 12 RPH diesel engines, each developing 372 b.h.p. at site, will be installed on a platform twenty-five miles from Fao, an oil terminal on the mainland of Iraq.

Electronic Forum Bulletin

The first issue of the "Bulletin of the Electronic Forum for Industry," giving details of the latest achievements of the electronic industry and showing new applications of electronic equipment which are of interest to users in commerce and industry, has recently been published. The E.F.F.I. was formed in 1958 to inform all users and potential users of electronic equipment of the wide and varied scope of the electronics industry. Constituent members are the British Electrical and Allied Manufacturers' Association, the British Radio Valve Manufacturers' Association, the Electronic Engineering Association, the Machine Tool Trades Association, Inc., the Office Appliance and Business Equipment Trades Association, the Radio and

Electronic Component Manufacturers' Federation, the Scientific Instrument Manufacturers' Association and the Telecommunication Engineering and Manufacturing Association.

The first number of the bulletin consists of articles based on papers read at an open day held earlier this year and covers such subjects as industrial mathematics and data reduction in the aircraft industry. Copies of the bulletin, which is to be published at irregular intervals, are obtainable from the Electronic Engineering Association, 11, Green Street, London, W.1.

Silicon Production

We mentioned last week the completion of an extension of the I.C.I. plant for the bulk production of semiconductor grades of silicon. The company says that the demand for silicon in Britain can be met and considerable quantities are being sold abroad so that extensions have been planned which will more than double capacity in 1960. These modifications will be made relatively simply as the original plant was designed for ready expansion.

Two distinct types of silicon are required at present by device manufacturers—lump or granular silicon, from which single crystals are made, and zone-refined silicon in rod form. Lump silicon (150-500 ohm/cm, p-type) is the form that I.C.I. has been marketing successfully so far. I.C.I. has been actively working on methods of growing silicon rods suitable for zone-refining, and is now installing a new plant which will be producing polycrystalline rods early in 1960. The rods will have diameters up to 1in and lengths up to 24in. They will have a smooth surface finish and this, together with their very small variations in physical dimensions, will enable them to be used without further processing in zone-refining equipment. It will be possible to obtain high quality single-crystal rods after a few passes in the zone-refiner.

B.L.C. Reception

The British Lighting Council recently held a reception at its London headquarters for district managers and commercial managers of the London Electricity Board, and London branch managers and senior lighting engineers of members of the Lighting Equipment Development Council and the Electric Lamp Industry Council, when the accompanying photograph was taken.

Remington Competition Result

The winners of the recent "Shave the Stars" contest arranged by the Electric Shaver Division of Remington Rand, Ltd., were presented with their prizes at a luncheon in London last week. The presentations were made by Mr. John J. Collins, general sales manager, and the winner of the first prize, choice of a Jaguar car or £1,500, was Mr. R. Burchell, of South Shields, Co. Durham. He decided to take the cheque for £1,500.

The entry form used for his prize-winning entry was obtained from Mr. Catch, of Gerards Radio, Television & Electrical Repairs, of North Shields, who received a special dealer's prize of £100. The second prize (£100) was won by Mr. F. J. Pelling, of Harlow, Essex.

Among the guests at the luncheon were Sidney James and Freddie Mills, two of the four well-known artistes who co-operated in the competition.

Diesel Engine Film

A new version of the film, "The Peterborough Diesel Story," has just been produced by the Perkins Film Unit. The film, the third edition, is in 16 mm colour, runs 27 minutes and is narrated by Frank Phillips. It will also be available with commentaries in French, German and Spanish. It includes views of Peterborough and the surrounding district, aerial and interior shots of F. Perkins, Ltd.'s, Eastfield factory, and shows various types of vehicles, boats, tractors, combine harvesters and industrial equipment with Perkins engines operating in Britain and overseas.

Engineering Production and Orders

Production in the engineering and electrical goods industries in August showed the full effect of the seasonal fall during the holiday period but was 4 per cent more than in August, 1958. Preliminary estimates by the Board of Trade for September indicate that there was a similar increase in the rate of production compared with 1958.

The volume of total orders on hand has remained virtually unchanged since the end of March, and though export orders have increased slightly during this period, they are still well below the 1958 level for the corresponding period. Nevertheless, the stability of orders on hand this year, in contrast with the fall throughout 1958, coupled with increasing production, indicates an increase in the rate at which new orders have been received. Detailed figures of deliveries of the main electrical engineering product groups during the second quarter of 1959 are shown in the table.

DELIVERIES OF MAIN ELECTRICAL ENGINEERING PRODUCTS

	Second quarter 1958	Second quarter 1959
	(£ million)	
ELECTRICAL MACHINERY—		
Rotating electrical machines	30·1	30·9
Transformers for lighting, heating and power	10·7	10·0
Switchgear and control gear	27·4	27·8
Other electrical machinery	4·0	4·0
INSULATED WIRES AND CABLES	27·8	29·5
OTHER ELECTRICAL GOODS (except radio, telecommunication and other electronic apparatus)—		
Domestic electrical appliances	23·1	36·5
Electrical equipment for motor vehicles, cycles and aircraft	14·2	16·1
Primary batteries	2·6	2·8
Secondary batteries (accumulators)	5·1	5·7
Electric lamps	4·0	4·3
Other electrical goods	15·4	17·2

Floor Heating Company

The registration and development of Thermoduct, Ltd., as a separate company (although still with the same directors as the parent company) will enable the new company to concentrate wholly upon the supply of "Thermoduct" electric floor heating equipment and associated control gear. HVE (Electric), Ltd., will continue to manufacture electrode boilers, circulator boilers, fan heaters and control panels for all kinds of electrical installations.

George Cohen 125th Anniversary

The George Cohen 600 Group, Ltd., is this month celebrating the 125th anniversary of the founding of the business by George Cohen in 1834. Today the turnover of the group is some £30 million a year; it has over thirty subsidiaries at home and overseas; and it employs assets of about £17 million. The George Cohen business, having outgrown successively its original premises in Aldgate and

At the British Lighting Council reception. Left to right: Mr. R. H. Rawll (L.E.B. district manager, Northern District), Mr. C. A. Phillips (L.E.B. commercial engineer, West End District), Mr. W. J. Jones (director, B.L.C.), Mr. C. J. W. Scott (vice-chairman, E.L.I.C.), and Mr. W. J. Sageman (L.E.B. district manager, West End District)

ELECTRICITY YOUR WILLING SERVANT
MANSION OR MAISONNETTE
ELECTRIC SPACE HEATING TOPS THE POLL
FOR IMMEDIATE WARMTH AT COOLER TIMES

The winning display by Grange-over-Sands Service Centre in the North Western Electricity Board's competition

its subsequent larger headquarters, moved, in 1876, to offices and wharves at 600, Commercial Road, from whence the "600" in its title is derived. Although those premises are still in use as one of George Cohen's scrap depots, the group's headquarters have moved to Wood Lane, W.12. The company was made public in 1947 and the present chairman is Mr. Cyril M. Cohen, the grandson of the founder; five of his colleagues on the group board are also direct descendants. The 600 Group employs 8,000 people, of whom some 500 have more than twenty-five years' service.

Scottish Company's New Showrooms

James Scott & Co. (Electrical Engineers), Ltd., whose business includes electrical contracting work, a manufacturing and electronics division, and electrical retailing, have recently opened extended premises at their branch in High Street, Dunfermline, which add 3,300 sq ft of floor space to the original showroom.

The extension is housed in a two-storey building, with a showroom on each floor. The company has ten shops throughout Scotland and the extended Dunfermline showrooms are now the largest. They are divided into sections, each dealing with a particular type of equipment, including space heating, house-cleaning equipment, cooking and mixing apparatus, and home laundry equipment. Later a demonstration theatre is to be opened for the demonstration of "Hi-fi" equipment.

Window Display Competition

Grange-over-Sands Service Centre, in the North Western Electricity Board's No. 6 Sub-Area, has won the 12th annual window display competition. The winning window was mounted by Mr. J. Riley, senior service centre assistant. Nearly 100 Board service centres entered the competition, the theme of which was "Comfort Heating." The displays were first judged on a Sub-Area basis and the final area judging was conducted by a panel which, apart from Board members and senior officers, included display specialists. Second place among the Sub-Area winners was awarded to Bacup (No. 5 Sub-Area), with Chorley (No. 4 Sub-Area) taking third place. Other Sub-Area winners were Longsight (No. 1 Sub-Area), Ashton-in-Makerfield (No. 2 Sub-Area) and Wilmslow (No. 3 Sub-Area).

St. Dunstan's

Once again the annual report of St. Dunstan's is a reminder of the valuable work which this institution is doing for those blinded in the two wars, and the ever-present need of financial support. The 1958-59 report, "The Art of Blindness," illustrates some of the work which is being done in industry and commerce and on the welfare side.

Royal Visit to Smith's Cricklewood Factory

Prince Philip visited the works of S. Smith & Sons (England), Ltd., on 19th November. He was greeted by the chairman, Mr. R. Gordon-Smith, and during his tour of the factory met and spoke with many of the employees. He saw many examples of motor accessories being made and was particularly interested in the development and engineering laboratory.

Batti-Wallahs' Society

There was a large gathering last week for the last luncheon of the year of the Batti-Wallahs' Society to listen to Mr. Donald Campbell give an interesting address on land and water speed records, in the course of which he said that preparations were in hand for his attempt next year to exceed his present world land speed record. He also spoke of the value of these speed attempts in design research and in boosting British car industry prestige. Mr. J. Temple Hazell (president of the Society) was in the chair, and Mr. J. W. Perkins (a past-president) proposed the vote of thanks to Mr. Campbell.

The next luncheon of the Society will be on Wednesday, 27th January, when the guest speaker will be Sir John Simpson, Controller of H.M. Stationery Office.

Trade Announcements

The **Plessey Co., Ltd.**, announces that production of the range of "Modac" connectors, hitherto carried out by its associate company, Modern Acoustics, Ltd., at Boreham Wood, Herts, has now been transferred to the Wiring and Connectors Division of Plessey at Cheney Manor, Swindon.

Drial Automation, Ltd., Abbey Wall Works, Station Road, Merton Abbey, London, S.W.19, has been formed to take over from **B.-J. & W. Automation, Ltd.**, the production and marketing of "Drial-Major" drying cabinets.

Mr. R. E. Stokes, 38, Sanderstead Court Avenue, Sanderstead, Surrey (telephone: Sanderstead 2504), has recently been appointed technical representative in the London area of **Steatite & Porcelain Products, Ltd.**

The head office, accounts and sales of **Elliott Domestic Appliances, Ltd.**, are now at Elmgrove Road, Harrow, Middx. (telephone: Harrow 6411), and the Service Department and warehouse are at 416, Derby Road, Greenford, Middx. (telephone: Waxlow 5631).

A. S. Duran & Co., Ltd., electrical wholesalers, Reading, are opening a new branch on 7th December at Spa Road, Southampton (telephone 23091), under the management of Mr. C. V. Burrows. The company are stockists of electrical equipment and accessories and of domestic appliances. The new branch will include a warehouse and trade counter.

Crypto, Ltd., has appointed Mr. G. W. Bennett as its special marine representative in succession to Mr. J. R. Clayton, who will be retiring at the end of this year after twenty-three years' service.

Nettle Accessories, Ltd., has moved its London office and depot to new premises at 11-12, Paddington Green, London, W.2. The telephone number (Ambassador 3231/2) is unchanged.

Mr. A. L. Mills has joined **Parkinson Cowan Appliances** and will represent the Electrical Division in Kent, Surrey and Sussex.

Aircraft-Marine Products (Great Britain), Ltd., which markets A-MP solderless terminations, is now at Amplo House, 87-89, Saffron Hill, London, E.C.1 (telephone: Chancery 2902-8).

Change of Name

The British Vacuum Cleaner & Engineering Co., Ltd., is holding an extraordinary general meeting on 17th December for the purpose of passing a special resolution to change the name of the company to Goblin (B.V.C.), Ltd.

INDUSTRY AND THE HOUSE

National Fuel Policy Suggestions

By AUSTEN ALBU, M.P., B.Sc., A.M.I.Mech.E., M.I.P.E.

As Mr. Woodrow Wyatt, who now represents the mining constituency of Bosworth, said in the debate on the Coal Industry Bill, we have a sort of "love-hate relationship" with mines and miners. But then the miners themselves have a similar relationship to their industry. On the one hand they emphasise the dangers and hardships of their occupation and, on the other, demand protection for it from the encroachments of alternative sources of energy.

It was the latter which dominated the speeches of the Opposition, although the true attitude of the miners was probably expressed by Mr. William Stones, the member for Consett, who admitted that he would say "close the pits" if by some miracle we could guarantee our fuel requirements and at the same time place all miners in other jobs. A new member straight from the coal face, Mr. Thomas Swain, of North-East Derbyshire, welcomed mechanisation because, as he said, "the pick and shovel are the most soul destroying instruments ever invented by the mind of man."

The edge was to some extent taken off the miners' anxieties by the obvious humanity of the new Minister of Power, the Hon. Richard Wood. He withstood, however, the demands for a national fuel policy, the cries for which he had discovered were almost deafening, on the grounds of the variation of needs of different consumers and the difficulties involved in compulsion to use certain fuels rather than others. He admitted, however, that in the country's search for cheap power we could not disregard wider economic considerations or ride roughshod over human difficulties.

It became clear during the debate that it was social and human considerations which had led to the current high levels of stocks, which were put by Mr. Nabarro at 53 million tons if distributed stocks were included. It was on the possibility of getting rid of these stocks that scepticism about the Coal Board's revised plan fastened. Many members pointed out that the closing of uneconomic pits would increase output per man-shift and, if fuel efficiency continued to rise and oil imports to increase at present rates, there might be difficulty in disposing of the output of the mines, which might well exceed the Board's figure of between 200 and 215 million tons in 1965. Opposition members claimed that oil was being sold at uneconomic prices and contrasted the lack of protection given to the coal industry with manufacturing industries and agriculture. The Minister, however, believed that the recent decline in the demand for coal had been based on special factors and was unlikely to recur. By limiting the Board's extra borrowing powers to £50 million without recourse to Parliament, he has ensured that the industry's problems will get another airing in the House of Commons within a year or two's time.

European Free Trade

The announcement of the signing of the convention establishing the European Free Trade Association (the "Seven") did not lead to any clarification of its effects on manufacturers in this country. Questions to the Chancellor were almost entirely devoted to frozen fish fillets, the level of imports of which was the last obstacle to the signing of the convention. Commonwealth preference is to remain and discussions will continue with the Governments in the European Economic Community (the "Six"). Whether we can have the best of all commercial worlds remains to be seen.

Radcliffe Committee's Report

On Thursday last week the House debated the esoteric subject of the monetary system, on a motion that the Government took note of the Radcliffe Committee Report. To this the Opposition moved an amendment which not only welcomed the Report but called on the Government to supplement those several recommendations which confirmed the Opposition's view of how financial policy should be determined. They produced a debate of surprising liveliness, chiefly because of the speeches of some back benchers. Two ex-Treasury Ministers, Mr. Nigel Birch and Mr. Enoch Powell, spoke, the former with sarcastic wit and the latter with donnish severity, in favour of the pure milk of monetary orthodoxy. Against them Mr. Anthony Crosland, the economist whose return to the Labour benches is generally welcomed, and Mr. Harold Lever, a lawyer with a practical and racy style, argued that to proclaim that the value of the pound must be maintained at all costs overlooked the other, and equally desirable, objectives of economic policy: full employment and expanding output.

Bank Rate Decisions

In a field in which economists violently disagree it would be too much to expect politicians to see eye to eye. The Chancellor accepted the substance, if not the form, of the Committee's recommendation that his supremacy in deciding changes in the Bank Rate should be made clearer and made some steps towards closer collaboration between the Treasury and the Bank of England. He resisted, for the time being, pressure from behind him to make the nationalised industries raise their funds on the market; but rejected the Committee's recommendation that the local authorities should be allowed, if they wished, to use the Public Works Loans Board. Perhaps the most useful suggestion that came from the debate was Mr. Harold Wilson's proposal that, in order to increase international liquidity at a time of rising world trade, countries which are members of the International Monetary Fund should agree to treat their deposits with the fund as gold. He hoped, in time, to see the I.M.F. transformed into a sort of International Central Bank.

In reply to a question by Mr. W. Griffiths, the Parliamentary Secretary to the Ministry of Power (Mr. J. C. George) said that the average cost of electricity had increased between 1949 and 1958 by 29 per cent; that the number of generation employees per 1,000 kW of output capacity had fallen between 1948 and 1958 from 2·85 to 1·74; and that the performance of the industry was indeed satisfactory.

Nuclear Radiation and Reactor Materials

THE forty-sixth Thomas Hawksley Lecture was delivered at an ordinary meeting of the Institution of Mechanical Engineers on 25th November by Professor A. H. Cottrell (Department of Metallurgy, Cambridge University). His subject was the effect of nuclear radiation on engineering materials, with especial reference to bombardment by fast nuclear particles in gas-cooled, graphite-moderated reactors. The various reactor projects, he said, moved forward or dropped back according to how their specific problems were overcome; thus the homogeneous aqueous reactor, splendid on paper, had no future unless corrosion by uranium salt solutions could be avoided. The effect of radiation on graphite had led to the closing down of the Windscale reactors. A successful technology for handling hot liquid sodium was vital to a fast reactor and the further development of the gas-cooled reactor depended on mastering problems concerning uranium dioxide, beryllium and impervious graphite.

The competitive need to work fuel elements to nuclear limits of their life and to minimise neutron-absorbing structural materials as well as keeping everything inside a reactor as hot as possible strained all substances in resisting irradiation, creep and corrosion attack. Most reactor materials were metallic and so less liable to radiation damage than others, but except such metals as aluminium, magnesium, graphite, beryllium, zirconium, silicon and (to a far less extent) steel, they absorbed too many neutrons. The exceptions named had, however, disadvantages (including in many cases cost and strength) compared with ordinary structural metals.

Three main types of radiation damage were: electronic, in which electrons were knocked out of their orbits into states of higher energy; knock-on, in which entire atoms were displaced by collision with a nuclear particle with cascading effect; and transmutation, in which a neutron entered an atomic nucleus and caused transformation to a different chemical element, often emitting enough energy to produce severe electronic and knock-on damage.

Sensitivity to electronic damage varied widely, from organic substances, especially long-chain polymers (which became practically useless for insulation or lubricants in a few hours) to metals, in which electrons were free to flow like a fluid to fill any gaps immediately.

During a long reactor life (say, 20 years), component materials had every atom knocked out of place at least once. Some materials, especially metals, could anneal out damage provided the specific temperatures were not too low; aluminium, for instance, was unaffected by neutron bombardment down to $-50°C$.

Slow neutrons might be at least as harmful as fast through the ejection of alpha particles with a release of high kinetic energy. The extreme example was the fission of uranium, each atom of which was knocked out of place within two weeks of irradiation in a power reactor.

A small proportion of the energy received by graphite from fast neutrons was stored in vacancies and interstices and later released as heat which could raise the temperature by several hundred degrees within a few minutes. In large power reactors, however, which operated at higher temperatures, defects were mostly annealed out on formation and stored energy was built up to a much smaller degree.

After discussing the mechanism of radiation hardening in metals such as fuel-element cans in relation to distortion of fuel rods, Professor Cottrell discussed radiation hardening of metals and the prevention of brittle fracture of reactor pressure vessels. The most serious practical effects of radiation were in regard to changes in shape and volume of uranium fuel, i.e. thermo-cycling, radiation growth (a theory to account for which was suggested) and swelling due to the formation of gaseous fission products, mainly krypton and xenon, inside the metal. A physical theory, worked out in the lecture, was suggested as a way of overcoming some of these difficulties.

Automatic Control in Russia

A REPORT of a visit to the Soviet Union last May to study progress in automatic control applied to industrial production has just been published by the Department of Scientific and Industrial Research. The team concluded that the development of automatic control systems in Russia was at present, on the average, not so far advanced as in Britain. In particular, little evidence of work on the more advanced forms of control of chemical processes was to be seen. On the other hand, there was considerable activity on control in the steel industry. Work seemed to be well ahead in the telemetering field and on the control of electric power systems with long transmission lines. This work was generally similar to that in progress in this country, but appeared to have been given some degree of priority because of the special needs in the Soviet Union. There was found to be no close equivalent in Russia to such organisations as the Institution of Electrical Engineers. The team were told that 83,000 students graduated in engineering in 1958 and it was found that the connection between teaching, research and industry was good and there was a good deal of interflow of personnel between these activities.

At the Institute of Electro-Mechanics, Leningrad, the team saw some of the development connected with large electrical machine design. Design work on a 1,000 MW generator unit with special attention to the design of the cooling system was being carried out. There was also a design project of a 750 MW turbo-alternator which would be a twin set consisting of two 375 MW machines with a common boiler unit. The rotor diameter proposed was 1,250 mm at 3,000 r.p.m.

Computers in Production

AN informal discussion on "The Computer in Production" is being arranged by the Institution of Mechanical Engineers to introduce chartered mechanical engineers and managers to the latest techniques involving the application of computers in production, and to provide a forum for managers, engineers and users to present their views to computer manufacturers.

The meeting will be held on 21st and 22nd March next. Several engineers and computer users will give talks on the subject followed by an informal discussion. Visits to computer centres and to installations where computers are being used on production problems will be arranged. The meeting will be open to members and visitors, and is aimed primarily at management level; but the subject treatment is also likely to be of interest to specialists in computers. Those who wish to attend should apply to the Secretary, Institution of Mechanical Engineers, 1, Birdcage Walk, Westminster, London, S.W.1.

LOW-PRESSURE RESINS

THEIR APPLICATION TO SOME HIGH-VOLTAGE SWITCHGEAR DESIGNS

Authors' summary of a Supply Section paper entitled "The Application of Low-Pressure Resins to Some High-Voltage Switchgear Designs" by T. R. Manley, B.Sc., K. Rothwell, A.M.I.E.E., and W. Gray, A.M.I.Mech.E., A.M.I.E.E., which was read at an ordinary meeting of the Institution of Electrical Engineers on 26th November

FIRST used commercially in 1947 to insulate current and voltage transformers, low-pressure resins have since been widely used for other switchgear components, particularly those rated at between 6 and 15 kV. Two types of low-pressure resins, "epoxy" and "polyester," are used. Both these terms refer to classes of chemical compounds, usually derived from petroleum, which encompass a wide range of properties. As these resins are fluid at the moulding temperature and do not give off volatile gases whilst curing, they can be poured into simple moulds. They will also readily penetrate fine windings.

For casting purposes, a solid, high molecular weight, epoxy resin, known as "Araldite B," is preferred. When cured by phthalic anhydride, this formulation has the lowest coefficient of expansion and causes the least increase in temperature due to the chemical reaction. Polyester resins are used for impregnating since they are extremely fluid, cheap and have a long pot-life even when containing the peroxide catalyst which is used for curing. Polyester resins reinforced with glass fibres are also used for structural materials, although better results may be obtained with amine cured liquid epoxy resins.

The casting resin is mixed with silica to improve the electrical properties, especially the resistance to tracking, to reduce the shrinkage of the resin and to cheapen the product. It is essential to cast the resin under a high vacuum to prevent voids in the finished castings and care must be taken to exclude water.

Cause of Fracturing

Although the casting process is basically quite simple, there are a number of pitfalls which must be avoided. In the early designs, with straight conductors, the latter were greased to allow movement of the resin relative to the copper during contraction of the resin whilst it was curing and cooling; this worked well. With bent conductors of complicated shape, and particularly if there were more than two conductors embedded in the resin, cracking often took place. Investigation showed that the prime cause of fracture was the curing contraction. It was found that a very large part of this contraction occurred in a matter of minutes whilst the resin was in the gel state. The rate of change of volume also increased with changes of temperature.

As epoxy resins are good adhesives, it appears that a tearing action sometimes takes place because the laminæ of resin clinging to two parallel bars are bowed and lengthened, and this occurs when the resin is extremely weak. This was demonstrated by casting bars of copper and resin in unfilled resin, i.e. without the addition of silica. In this state, the resin is translucent and it is possible to examine the strain patterns with polarised light. The problem was completely solved by covering copper bars with a type of p.v.c. which was soft at the curing temperature and, because it did not adhere to the resin, allowed the resin to slip.

In the impregnation of a fine wire voltage transformer primary winding, the catalysed polyester resin is introduced under vacuum at room temperature. The winding alone is then heated and subsequently cast in epoxy resin. This method is suitable for quantity production and the unheated resin has a prolonged useful life. For the reinforcement of low-pressure resins, care must be taken to keep the glass fibres dry, if good electrical and mechanical properties are to be obtained. In an experiment with two 4in diameter tubes, one flashed across the surface between electrodes 9in apart at 24 kV, whilst a comparable tube in which the glass fibres were heated immediately before applying the resin to remove moisture withstood more than 65 kV.

Since power-factor/voltage tests were found to be unsatisfactory for measuring the quality of resin insulated articles, discharge tests were substituted. The policy adopted was that the discharge should not exceed 200 per cent at a voltage 15 per cent in excess of the working voltage. Work on this subject by several investigators indicates that suitably treated epoxy resins have a very long life, well in excess of that of synthetic resin bonded paper, when subjected to internal discharges at stress levels of 40 V/mil.

Some results of tests on epoxy resin insulated current transformers show that power arcs over the surface of or through the insulation are not liable to cause fires. When a flashover occurred over the surface of the insulation, the transformer was serviceable immediately after cleaning. The insulation was not damaged by immersion in water.

The advantages, in the design of switchgear, which derive from the use of these resins are best shown by examples. In the case of an outdoor oil circuit-breaker rated at 11 kV, 200 A, 150 MVA, it has been possible to reduce considerably the overall dimensions by insulating all three busbars as one unit and by casting the three wound type current transformers as one unit, complete with cable box bushings and thoroughfare bushings to the oil-filled chamber. Because the resin is virtually non-hygroscopic, no special precautions need be taken to prevent moisture collecting on the surface of the busbar end connections whilst the gear is being shipped or awaiting erection on site. Provided it is dry before making the joints, this is all that is required.

In a second example of an indoor air-break circuit-breaker rated at 11 kV, 1,600 A, 500 MVA, cranked bushings insulated with resin are used. These are rotated through 180° from the service position, to earth either the feeder or the busbars. This could not be easily achieved with any other form of insulant.

In the case of a flameproof circuit-breaker rated at 6·6 kV, 400 A, 75 MVA, considerable space is saved by

embedding the connectors from the busbars to the busbar orifices and the connectors from the current transformers to the feeder orifices in one unit. There is a special isolating feature required in conjunction with flameproof requirements. This allows the breaker to be removed without exposing live orifice connections. This sliding piece is cast in resin and embodies six primary through connections, as well as the twelve secondary connections required for auxiliary operation. In this kind of switchgear it is highly desirable that busbar joints should be readily accessible to enable panel extensions to be made quickly and safely; the more usual forms of compound-filled busbar joints are therefore a drawback. Resin enables lightly insulated busbars to be used with long air creepage paths.

The art of moulding low-pressure resins has progressed to the stage where castings can be made without high locked-up stresses, and fear of random fractures can be forgotten. It is doubtful if epoxy resins are suitable for unshaded outdoor situations where the surface is electrically stressed, and research continues for better resins for such situations.

DISCUSSION

Mr. C. J. O. Garrard (G.E.C.), opening the discussion, said that there was a tendency on the Continent to extend the use of all-insulated construction from medium-voltage gear to higher voltages, which should lead to a considerable saving in space and materials and therefore cut the cost of switchgear. The greatest trouble with the casting resins was cracking, which could occur not only during casting but during the subsequent life of the moulding, probably due to differential expansion. The authors pinned their faith to a p.v.c. coating on the conductors before casting the resin on them, but the softening temperature of p.v.c. was 120-130°C and that might impose a limitation on the permissible heating of conductors by short-circuit currents. There was also the possibility of chemical attack by the p.v.c. on the resin. An alternative would be to make the resin more flexible by certain additions to it to deal with radial expansion, and to deal with longitudinal expansion by designing the part so that relative movement of metal and resin did no harm.

Mr. N. Care (South Wales Switchgear) said that in their present design of current transformer they insulated the core and wound it with foamed rubber tape, putting the secondary above that and then the epoxy resin, in that way overcoming the mechanical stresses in the curing process. The primary winding was treated in the same way, electrical stresses being dealt with by a coating of metallised paper between the foamed rubber and the epoxy resin. The same treatment had been used for large copper bars or tubes, the foamed rubber tape being put between the resin and the copper. No difficulties had arisen with cracking.

Mr. D. M. Cherry (C.E.G.B.) confessed that whenever a new mixture of synthetic resin was put forward, he found it difficult to repress a shudder. The cycle was always the same. To begin with it had all the virtues and none of the vices of its predecessors, but after experience with it some of the virtues got a little tarnished and it developed interesting new vices, and by this time they were told of some new mixture which was much better and they went round the circle again. Up to 11 or 15 kV, he believed the material dealt with by the authors had considerable advantages, and for some time to come its greatest use would be in that range. Adequate experience of the material on a large scale in production and use should be obtained before going to higher voltages, because a great deal of investigation remained to be done on stress control.

Mr. W. J. Brown (Bushing Co.) maintained that whatever polyester resins could do, epoxy could do better, and described the epoxy resins as the most exciting insulating materials since the introduction of the phenolic resins. They might have a considerable influence on the shape and design of h.v. switchgear. Bushings could be bent in three planes if desired; insulators and busbars and bushings could be embodied in one casting, the casting containing its own means of support. He thought that they were on the verge of amazing developments in switchgear design.

Mr. H. Davies (C.I.B.A., A.R.L.) felt that insufficient emphasis had been given to the fact that true epoxy resins were non-fibrous materials with low water absorption and not likely to deteriorate in service due to absorption of moisture, contamination by foreign matter, erosion and so on. This made them suitable for switchgear used indoors under onerous climatic conditions. The weight of the evidence at the moment was against the use of epoxy resins outdoors, but experience on the Continent indicated that the position in that respect might be more hopeful than had been expected.

Dr. J. H. Mason (E.R.A.) described discharge resistance tests carried out at the E.R.A. on sheet insulating materials which showed that epoxy resin laminate compared favourably with phenolic resin but was not so good as the best silicone-glass laminates. The silicone-glass laminates showed, however, a very wide spread, many failing almost at once. Polyester glass proved less good than an epoxy glass. If the laminates were subjected to mechanical tension or strain, the discharge resistance was greatly reduced. With silicone there was more than a tenfold reduction in life with only 0·25 per cent of strain in the upper surface exposed to discharge; with epoxy resin 0·55 per cent strain reduced the life by 20 per cent.

Mr. K. H. Stark (English Electric Co.) said the experience of his company with epoxy cast components was similar to that of the authors. The curing times suggested by resin suppliers were often correct, but in one case where his company had found the time of cure to be 20 hours, the suppliers had recommended two hours. A cast resin component must be fully cured before leaving the factory, or the mechanical stresses set up in service might crack the resin. Control of the mechanical stresses within the resin was the key to producing satisfactory cast components. Much could be done by suitable design, which meant choosing simple symmetrical shapes and not embedding in the resin any large metal component with a sharp edge.

Mr. F. J. Miranda (Pirelli-General Cable Works), commenting on the authors' statement that at present it was uneconomic to use epoxy resins in switchgear above 15 kV, said that his company had come to the conclusion that for cable accessories it was uneconomic to use them above 33 kV. There were several reasons for this apparent contradiction, one being that, as switchgear manufacturers, his company could use only simple symmetrical shapes, which made it much easier to eliminate the contraction stresses which the authors obtained with their complicated shapes.

Combination with Porcelain

Mr. W. A. McNeill (Doulton Industrial Porcelains) asked whether any consideration had been given to a combination of porcelain and synthetic resin in a manner which would retain the advantages of both. He believed that by careful design, porcelain could be introduced into the moulds and the resin cast on, or, for other applications, porcelain could be superimposed as a skin over the resin where the resin was exposed to the atmosphere and subject to electrical stress. Another advantage would be the replacement of an expensive material by one which was more economic.

Mr. R. J. Males (J. R. Ferguson, Ltd.) did not agree with the authors that at present epoxy resins could not be applied economically above 15 kV. More than one method, he said, was available for providing stress control, and at least one of these had given good results. It was possible to incorporate stress shields in a moulding at the most advantageous points and so solve many insulation problems and effect economies. Mouldings for electronic apparatus with a working voltage of 170 kV and a test voltage of 400 kV had been satisfactorily manufactured in production quantities and mouldings of 100 kV r.m.s. with stress con-

trol shields for normal voltage work had been made satisfactorily. Work was in progress on the manufacture of a 33 kV outdoor circuit-breaker bushing with moulded stress screens, a porcelain shed being used for weather protection. There was every indication that this process could be applied to a 132 kV bushing. Production components 1⅜in thick had withstood a 900 kV peak impulse.

Mr. W. B. Robertshaw (South Wales Switchgear) suggested that it would be interesting to see the effect on the stress pattern of merely rounding off the edges of inserts, without using p.v.c. Other materials, which were merely deformable and hardly at all compressible, had the effect of rounding off the edges and spreading out the stress concentrations rather than reducing the overall stressing round the inserts. His company used foamed material, which was compressible, putting an electrostatic screen between the compressible layer and the casting. This rounded off the sharp edges, achieved an overall reduction in mechanical stress, prevented pressure on pressure-sensitive inserts—such pressure could, for example, alter the magnetic properties of grain-oriented steel—, accommodated the expansion of copper on short-circuit heating and provided adequate ionisation levels.

Mr. W. Gray replied briefly to the discussion.

ELECTRICAL ENGINEERING RESEARCH

A STATISTICAL survey carried out by the Department of Scientific and Industrial Research in 1955 revealed that, apart from Government investment in electrical research, the electrical industry of this country probably spends more of its own money on research than any other industry. This was referred to in a paper on research in a large electrical engineering concern presented at a joint meeting of the Association of Supervising Electrical Engineers and the Institution of Engineers-in-Charge on 17th November by Mr. H. K. Cameron of the General Electric Co.'s research laboratories at Wembley.

After a brief account of the growth and organisation of the Wembley laboratories, which were first occupied in 1922, he considered some of the principal research projects which had been undertaken in them. The laboratories were established to study lighting and were associated with the development of the first hot cathode low-voltage discharge lamps, the high-pressure mercury lamp and fluorescent lamps. New light sources such as electro-luminescence or the use of a quartz envelope for a tungsten filament lamp were still being considered, but much of the current research effort was being devoted towards obtaining cheaper lighting.

The other research subjects dealt with included measurement, communications systems and such electronic components as magnetrons, clystrons and ophitrons. Materials development included magnetic powders, magnetic oxides and synthetic crystals used for frequency control, produced by a hydro-thermal process. The greatest advances in this field, however, had been made in the development of semiconductors and transistors.

In many indirect ways this research had contributed to heavy engineering progress. The study of gas discharges for lighting and valves provided experience valuable to the development of mercury arc rectifiers, while work on semiconductors had led to power rectifiers and further development would lead to a silicon controlled rectifier with many of the characteristics of the thyratron. Compounds with good electrical conductivity and relatively poor thermal conductivity, such as bismuth telluride, held promise of useful application for electric cooling devices and might also be used for generating electricity from applied heat.

Modern methods of chemical analysis had contributed to engineering progress. Gas chromotography had been developed to provide rapid control of the composition of the gas used to fill lamps and also of the gas used as a coolant in a nuclear reactor. The phenomenon of creep under irradiation occurring with graphite had recently been demonstrated, and graphite impermeable to gases at relatively high temperatures had been developed which might well be of value as a fuel element canning material.

It was becoming increasingly evident that for a research project in any new field to be successful there must be a large investment. The design and construction of atomic power stations was one of several examples of new activities requiring the setting up of considerable research and development facilities, others being guided missiles and computers.

SWITCHES FOR ELECTRIC SIGNS

From a Correspondent

A PROVISION which was in the Kent County Council Act 1958 and previously appeared in local Acts promoted by Liverpool and Leeds has now been reproduced once again in the Bootle Corporation Act 1959 with the addition of a penalty clause. Section 62 of the Kent County Council Act provides that as from the appointed day in any district " any luminous tube sign or other similar apparatus requiring the transforming of electrical energy to a higher voltage fitted externally or internally on or in any premises in that district other than such apparatus which is fitted internally in any premises and is attached when in operation and is used for lighting only and is already fitted with a readily accessible switch in the low-voltage side of the apparatus shall be provided with a ' cut-off ' switch on the low-voltage side of the transforming apparatus."

Before any such apparatus is provided the owners or occupiers of the premises are required to give at least 14 days' notice to the local authority indicating the proposed position of the " cut-off " switch and in the case of internal fittings indicating the pattern of the " cut-off " switch which it is intended to provide. The owners are required to take into consideration the views of the local authority after they have consulted with the fire authority to ensure that it is easily recognisable by and accessible to firemen. Where the premises concerned are licensed under the Cinematograph Acts 1909 and 1952 and therefore already subject to control there is only need for the owners and occupiers to notify the authority of the position of the switch.

These signs are usually erected by private contractors and the connections to the mains are carried out by the Electricity Boards concerned. It seems elementary that electricity authorities must ensure that there is a proper " cut-off " switch before the connection is made. This being so it appears that the most that might be expected is that the electricity authority, from courtesy, might notify the fire authority of the position of the switch. To invite the local authorities and the fire brigades to comment on the placing of switches, and to promote legislation to cover this point, would appear to cast an unwarranted reflection on the electrical undertakings.

DOMESTIC ELECTRICAL EQUIPMENT

CLEANERS AND POLISHERS

IN most homes possession of some form of cleaning appliance is essential. Electric vacuum cleaners and, in more recent years, electric floor polishers, have now come to be regarded as the accepted method of dealing with this particular household chore—in fact, approximately 65 per cent of the wired homes in this country make regular use of a vacuum cleaner.

In the following survey we include the details of over thirty different manufacturers' products. Basically, there are two types of vacuum cleaner, the cylinder model with an internal dust bag, and the upright cleaner with an external bag. Most manufacturers produce both types, but it would seem that the cylinder models are among those most in demand. Whichever model is preferred, however, is largely a matter of personal choice. The cylinder cleaner with its greater manœuvrability and additional accessories will probably be favoured for general all-round use, but where there is a considerable expanse of carpeting the upright model is perhaps the more suitable.

Mention may also be made of the spherical-shaped cleaners (see Hoover and Morphy-Richards) which, because of their extra long hoses and greater suction power, can be placed in a central position from where cleaning can be conveniently carried out even in the farthest corners of the room.

There are also a number of hand types available, primarily intended for cleaning in places where a full-sized machine would be too heavy or otherwise inconvenient to use.

A vacuum cleaner is cheap to operate and reliable in use. The motor, usually about ¼ to ½ h.p., consumes only a small amount of electricity and running costs are thus very low. Much the same applies to the electric floor polisher. Running costs are, in fact, almost negligible, but floors can be polished in a tenth of the time taken by hand. Both two- and three-brush types are equally popular and several models also tackle wet scrubbing and, with the addition of attachments, can be adapted for sanding, buffing or scouring.

Prices of all cleaners and polishers are lower than when our last review was published, mainly because of purchase tax reductions earlier this year. Extensive price reductions were, however, recently announced by Hoover, Ltd., the most noticeable among them being the price of their "Constellation" cleaner which has been reduced by over £9. At the same time the company also announced a new version of this cleaner.

VACUUM CLEANERS

Manufacturer	Name or Model	Type	Motor	Special Features	Accessories	Finish	Price (excl. tax)	Purchase Tax
A.E.I.-HOTPOINT, LTD., 33, Grosvenor Place, London, S.W.1.	"420"	Upright	250 W	Patented inner air-sleeve, foot operated switch	Full set brushes and nozzles	Grey stoved enamel, red, green or maroon bag	£18 12 10 plus £3 18 1 (accessories)	£3 8 2 plus £0 5 11 (accessories)
BRITISH VACUUM CLEANER & ENGINEERING CO., LTD., Goblin Works, Leatherhead, Surrey.	"Ace" G.71	Cylinder	500 W	Powerful motor combined with quietness	Full set brushes and nozzles	Green and maroon	£22 3 10	£4 1 2
	"Triumph" G.57	Cylinder	300 W	For the medium sized house	Full set brushes and nozzles	Ivory body and almond green	£15 10 8	£2 16 10
	"Popular" G.141	Cylinder	300 W	Low cost	Sufficient for all cleaning needs	Almond green body, chromium end covers	£13 6 4	£2 8 8
	"Minor" G.14	Cylinder	300 W	Low cost	Sufficient for house cleaning	Ivory body, almond green end covers	£10 7 2	£1 17 10
	"Wizard" De Luxe G.41	Upright	250 W	Beater brush	Full set brushes and nozzles	Ivory and blue enamel, blue dust bag	£16 8 5 plus £3 13 8 (accessories)	£3 0 1 plus £0 5 10 (accessories)
	"Imp" G.8	Hand Cleaner	175 W	Ideal for small spaces	Sufficient for house cleaning	Grey, burgundy dust bag	£8 4 10	£1 10 2
BROWN BROTHERS, LTD., Great Eastern Street, London, E.C.2.	"Duco Junior"	Cylinder	230 W	Fully suppressed radio and T.V.	Nozzle, oval brush and crevice tool	Rexine body with matching ends	£8 13 4	£1 11 4
	"Duco Super Silent De Luxe"	Cylinder	350 W	Fully suppressed radio and T.V. Completely shrouded motor	Nozzle, triangular and oval brushes, crevice tool	Rexine body, chromium ends. Black handle incorp. foot press switch	£12 13 4	£2 5 9
	"Duco Blue-Riband"	Cylinder	230 W	Fully suppressed radio and T.V. Swivelled hose, recessed switch	Nozzle, triangular and oval brushes, crevice tool	Rexine body, cast ends	£10 13 4	£1 18 6
	"Duco Balmoral"	Cylinder	350 W	Fully suppressed radio and T.V. Swivel hose connections in both end covers	Full set including disposable paper dust bags	Cream with brown end covers	£11 10 9	£2 2 3
	"Duco Major"	Upright	275 W	Fully suppressed radio and T.V. Motor driven brush agitator, adjustable nozzle	Nozzle, oval brush, crevice tool, 2ft tube extension and flexible hose	Maroon body and bag	£12 17 6 plus £3 4 0 (accessories)	£2 6 6 plus £0 5 9 (accessories)

Manufacturer	Name or Model	Type	Motor	Special Features	Accessories	Finish	Price (excl. tax)	Purchase Tax
BROWN BROTHERS, LTD., Great Eastern Street, London, E.C.2 *(continued)*	"Duco Standard"	Hand	150 W	Fully suppressed radio and T.V. Lightweight all-rubber nozzle incorp. brush	—	Maroon body and bag	£6 2 1	£1 2 1
	"Duco De Luxe"	Hand	150 W	Fully suppressed radio and T.V. Detachable metal nozzle, 2ft tube extension	Ext. tube, furniture brush and crevice tool	Maroon body and bag	£6 15 9	£1 4 6
	"Duco Super"	Hand	160 W	T.V. suppressed slide action switch	Ext. tube, oval brush, nozzle and crevice tool	Maroon and blue-grey	£6 15 0	£1 4 5
BYLOCK ELECTRIC, LTD., South Street, Enfield, Middlesex.	"Centurion De Luxe"	Cylinder	500 W	T.V. suppressed, balanced suction carpet nozzle, paper dust bags	Full set brushes and nozzles	Two-tone grey	£15 10 0	£2 16 9
	"Zephyr 350 De Luxe"	Cylinder	350 W	Switch in handle, paper dust bags, T.V. suppressed	Full set brushes and nozzles	Two-tone grey	£11 12 6	£2 2 6
	"Classic"	Cylinder	300 W	T.V. suppressed	Full set brushes and nozzles	Silver hammer and maroon	£9 9 6	£1 14 8
	"Minivac"	Cylinder, hand	180 W	T.V. suppressed	Nozzle, dusting brush, ext. wand	Off-white enamel body, chromium accessories	£7 5 0	£1 6 6
R. CADISCH & SONS, 38-46, Orsman Road, London, N.1.	"Cadison"	Cylinder	250 W	Swivel hose connection	Carpet nozzle, brush, crevice tool	Black diced leatherette, plated ends	£8 15 0	£1 12 9

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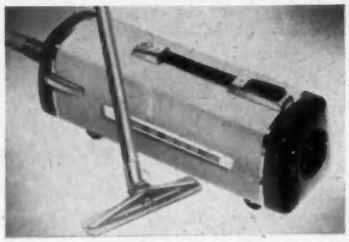

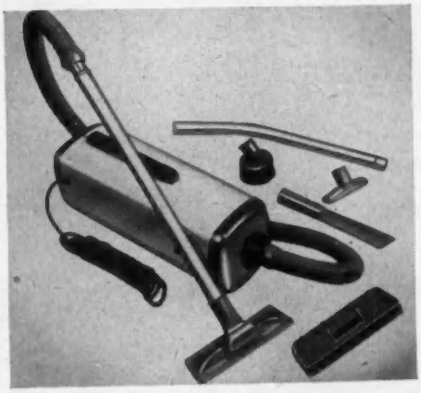

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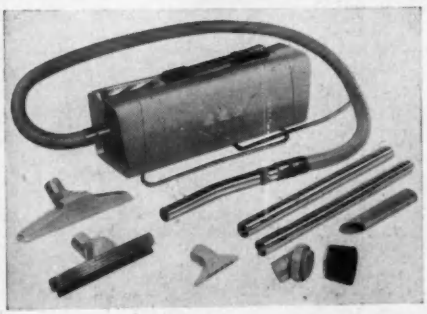
1. *Bylock "Centurion" de-luxe cleaner*
2. *B.V.C. "Goblin Ace" G.71 cleaner*
3. *Brown Brothers "Duco Balmoral" cleaner*
4. *B.V.C. "Goblin Wizard" de-luxe G.41 upright cleaner*
5. *A.E.I.-Hotpoint model 420 cleaner*

Manufacturer	Name or Model	Type	Motor	Special Features	Accessories	Finish	Price (excl. tax)	Purchase Tax
R. CADISCH & SONS, 38-46, Orsman Road, London, N.1. (*continued*)	"Cadison" 1013	Hand	160 W	Fitted with hard rubber nozzle	—	Black crackle	£5 19 6	£1 2 6
	"Cadison" 1024	Hand	160 W	Lightweight, contemporary styled	Ext. tube, brush, metal nozzle, crevice tool	Two-tone grey, black bag	£6 15 0	£1 4 9
	"Cadison"	Upright	275 W	Rubber wheels, insulated handle grip	2 ext. tubes, crevice nozzle, carpet nozzle and brush	Biscuit and brown	£12 12 6 £3 0 0 (accessories)	£2 7 3 £0 5 6 (accessories)
CO-OPERATIVE WHOLESALE SOCIETY, LTD., National Works, Hall Street, Dudley.	"Invincible" 6020	Cylinder	250 W	—	1 nozzle, 1 crevice tool, 2 brushes	Leatherette and chromium	£9 1 9	£1 14 1
	"Invincible" 6014	Cylinder	300 W	—	2 nozzles, crevice tool, 2 brushes	Leatherette and chromium	£13 0 0	£2 8 9
	"Invincible" 6021	Cylinder	300 W	—	2 nozzles, crevice tool, 2 brushes	Leatherette and chromium	£10 3 0	£1 18 1
	"Invincible" 6023	Hand	180 W	—	Crevice tool, ext. tube, floor-brush (ext. hose 11s 7d extra)	Metallic grey and maroon	£6 13 4	£1 5 0
EDMUNDSONS ELECTRICAL WHOLESALERS, LTD., 240-250, Ferndale Road, London, S.W.9.	"Summit" Standard	Cylinder	250 W	Toggle switch, T.V. suppressed	Grey plastic brushes and nozzles	Red patterned leathercloth, sprayed end caps	£8 11 0	£1 11 3
	"Summit" De-Luxe	Cylinder	250 W	Foot switch, radio and T.V. suppressed	Grey plastic brushes and nozzles	Red patterned leathercloth, nickel plated fitments	£9 13 4	£1 15 4
	"Summit"	Hand	160 W	Quick release bag, T.V. and radio suppressed	Ext. tube, brush and 2 nozzles	Grey and red	£6 19 6	£1 5 6
	"Summit"	Upright	275 W	Slide action switch, T.V. and radio suppressed	Full set brushes and nozzles	Grey handle, red bag	£12 17 6 £3 0 0 (accessories)	£2 7 1 £0 4 11 (accessories)
	"Super Summit"	Cylinder	350 W	Tubular runners, foot switch, 3-stage impeller, T.V. and radio suppressed	Full set brushes and nozzles inc. carpet nozzle/floor brush	Red patterned leathercloth, chromium fitments	£13 9 4	£2 9 3
	"Summit Diamond"	Cylinder	350 W	Double insulated, foot switch, T.V. and radio suppressed	Full set brushes and nozzles inc. carpet nozzle/floor brush	Two-tone grey and maroon	£11 5 0	£2 1 2
	"Summit Twin"	Twin cylinder	550 W	Double insulated, nylon castors, T.V. and radio suppressed	Dapple green plastic brushes and nozzles	Two-tone green	£25 18 8	£4 14 10
ELECTRIX, LTD., Sterling Works, Dagenham, Essex.	"Sterling" 161	Cylinder	350 W	Foot switch, screw-in hose, swivelled carpet nozzle, suppressed, up-the-stairs skids	Full set of brushes and nozzles, and de-mother and spray-gun	Black and chromium	£17 5 0	£3 3 1
	"Sterling" 141	Cylinder	350 W	Foot switch, screw-in hose, swivelled carpet nozzle, suppressed, up-the-stairs skids	Full set of brushes and nozzles, and de-mother and spray-gun	Grey and maroon	£16 11 6	£3 0 7
	"Sterling" 181	Cylinder	350 W	Foot switch, screw-in hose, swivelled carpet nozzle, suppressed	Full set brushes and nozzles	Two shades of grey	£12 10 0	£2 5 9
	"Sterling" 151	Cylinder	250 W	Screw-in hose, suppressed	9in floor nozzle, 8in floor brush, upholstery nozzle, crevice tool	Maroon and grey	£9 0 0	£1 12 11
ELECTROLUX, LTD., 153-5, Regent Street, London, W.1.	"Electrolux 62"	Cylinder	450 W	Extra mobility, throw-away dust bags, foot switch	Full set brushes and nozzles, sprayer	Light grey plastic covering, dark green ends	£23 7 1	£4 5 5
	"Electrux 60"	Cylinder	300 W	Foot switch, air purification pad	Full set brushes and nozzles	White, black or red leathercloth, maroon end pieces	£18 19 6	£3 9 5

Manufacturer	Name or Model	Type	Motor	Special Features	Accessories	Finish	Price (excl. tax)	Purchase Tax
EXPRESS VACUUM CLEANER CO., 96, Bath Street, Birmingham, 4.	"Express"	Cylinder	200 W	—	Full set brushes and nozzles	Black rexine and chromium	£16 0 0	£3 0 0
FALK, STADELMANN & CO., LTD., 91, Farringdon Road, London, E.C.4.	"Cleanette" U.95737	Hand	160 W	Brush nozzle	—	Two-tone grey	£6 13 5	£1 4 5
	"Cleanette De-Luxe" U.95738	Hand	160 W	Swivelled carpet nozzle, curved ext. tube	Brushes, nozzles, crevice tool and tubes	Two-tone grey	£8 2 8	£1 9 9
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.	"DM.380A"	Upright	150 W	Double insulated. Suppressed for radio and T.V.	Full set brushes and nozzles	Grey and maroon	£18 2 8 £3 13 4 (accessories)	£3 6 4 £0 5 2 (accessories)
	"DM.540"	Cylinder	500 W	Double insulated. Suppressed for radio and T.V., quiet running	Full set brushes and nozzles, and paper dust bags	Moonstone grey and red	£19 19 11	£3 13 1
GENWIND, New Trading Estate, Lode Lane, Solihull, Birmingham.	Genwind "One-Hand"	Hand	100 W	Lightweight	—	Black crackle and chromium	£7 0 0	£1 5 7
HOOVER LTD., Perivale, Greenford, Middlesex.	"652" De-Luxe	Upright	380 W	Exclusive agitator with beater bars and brushes. "Disposall" dust bag. "Dirt-finder" light. "Hooverflex" double-stretch hose. Instantly attached tools	Full set brushes and nozzles in flexible non-scratch plastic	Pearl white and heather rose	£30 6 3	£5 13 9
	"1334" Junior	Upright	250 W	Exclusive agitator with beater bars and brushes. "Hooverflex" double-stretch hose. Instantly attached tools	All-purpose brush set in flexible non-scratch plastic, crevice nozzle	Pearl white and deep rose	£21 4 6 £3 11 9 (accessories)	£3 19 7 £0 5 7 (accessories)



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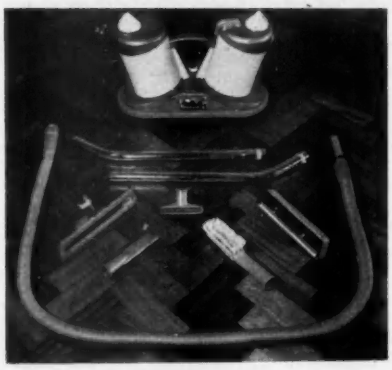

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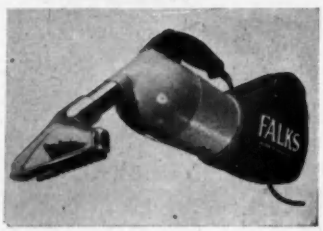
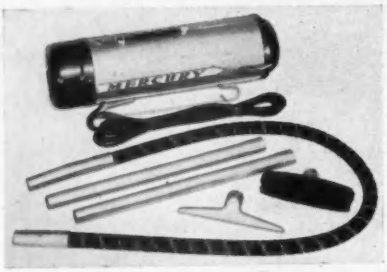


6. *G.E.C. model DM.540 cleaner*
7. *Edmundsons "Summit Twin" vacuum cleaner with accessories*
8. *Electrix "Silent Sterling" cleaner*
9. *Electrolux "Electrux" model 60 cleaner*
10. *Falk Stadelmann "Cleanette" hand cleaner*

Manufacturer	Name or Model	Type	Motor	Special Features	Accessories	Finish	Price (excl. tax)	Purchase Tax
HOOVER, LTD., Perivale, Greenford, Middlesex. (*continued*)	"912" Heavy-duty	Upright	330 W	Exclusive agitator with beater bars and brushes. "Dirt-finder" light	—	Black and grey metal	£25 15 0	£4 16 7
	"417E"	Cylinder	465 W	"Hooverflex" double-stretch hose	Full set brushes and nozzles	Pearl white and wedgwood blue	£15 0 0	£2 16 3
	"Dustette" 2614	Hand	150 W	Shoulder strap. "Disposall" dust bag. "Hooverflex" double-stretch hose	Hose, ext. tube, 2 brushes set in flexible non-scratch plastic and crevice nozzle	Dark blue and pearl white	£9 13 8	£1 16 4
	"Dustette" 2504	Hand	150 W	—	All-purpose cleaning brush	Dark blue and pearl white	£7 11 2	£1 8 4



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11. *Phœnix "Mercury" cleaner with accessories*
12. *Hoover "Dustette" model 2504 hand cleaner*
13. *Nash "Quikavac" upright cleaner*
14. *Pifco "Vacette" hand cleaner*
15. *Morphy-Richards "Super Suction" spherical cleaner*
16. *Hoover "Constellation" model 842 spherical cleaner*
17. *Parnall "Tenten" vacuum cleaner (Electrical Division of Radiation)*

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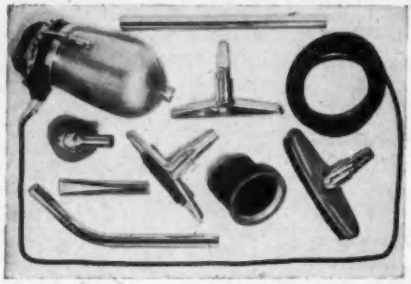
Manufacturer	Name or Model	Type	Motor	Special Features	Accessories	Finish	Price (excl. tax)	Purchase Tax
HOOVER, LTD., Perivale, Greenford, Middlesex. *(continued)*	"Constellation" 862	Spherical	580 W	"Disposall" dust bag. "Hooverflex" double-stretch hose, swivels through 360 deg	Hose, ext. tube, combined carpet and floor nozzle with brush and litter picker. All-purpose nozzle with litter picker. Dusting brush. Crevice tool	Pearl white and heather rose	£15 3 2	£2 16 10
LONOR, LTD., 1, Maddox Street, Regent Street, London, W.1.	"Siemens" VST.92	Hand	150 W	Perlon filter, radio suppressed, built-in switch	2 ext. tubes, carpet, hard surface, upholstery and crevice nozzles	Black and cream	£9 8 8	£1 10 4
	"Siemens" VST.101	Hand De-Luxe	220 W	Perlon filter, radio suppressed, D/P switch	2 ext. tubes, full set brushes and nozzles and polishing shoe, vaporizer and de-mother	Silver grey and red	£14 4 9	£2 7 3
	"Siemens" VST.203	Cylinder	360 W	Perlon filter, D/P pedal switch, radio suppressed	Full set brushes and nozzles (vaporizer, spray gun, polishing brush, etc., extra)	Silver grey and red	£17 4 0	£2 15 0
MORPHY-RICHARDS, LTD., 50, Conduit Street, London, W.1.	"Super Suction"	Spherical	775 W to 950 W	Powerful suction, brushes and nozzles in washable plastic	Full set brushes and nozzles	Two-tone beige and deep bronze enamel	£20 10 2	£3 14 1
NASH ELECTRICAL CO., LTD., 82, Snow Hill, Birmingham, 4.	"Quikavac"	Upright	140 W	Lightweight	Full set brushes and nozzles	Various colours	£12 0 0	£2 5 0
PHŒNIX APPLIANCES, LTD., Regina House, Marylebone Road, London, N.W.1.	"Popular"	Cylinder	230 W	—	Full set brushes and nozzles	Leatherette body, nickel ends	£8 7 5	£1 10 7
	"Gloria"	Cylinder	230 W	—	Full set brushes and nozzles	Leatherette body, nickel ends	£9 1 9	£1 13 3
	"Major"	Cylinder	230 W	—	Full set brushes and nozzles	Brown leatherette body, chromium ends	£10 3 9	£1 17 3
	"Clipper"	Cylinder	230 W	—	Full set brushes and nozzles	Leatherette body, Bakelite insets, chromium ends	£10 18 4	£1 19 11
	"Jet Power"	Cylinder	480 W	Extra power and suction	Full set brushes and nozzles	Blue body, chromium ends	£13 0 2	£2 7 7
	"Power Flo"	Cylinder (Box)	480 W	Extra power and suction	Full set brushes and nozzles	Grey body, maroon Bakelite ends	£13 0 2	£2 7 7
	"Cyclone"	Cylinder	250 W	—	Full set brushes and nozzles	Hammered body, red enamelled end caps	£9 15 3	£1 15 9
	"Mercury"	Cylinder	230 W	—	Full set brushes and nozzles	Hammered body, red enamelled end caps	£6 17 9	£1 6 3
PIFCO, LTD., Watling Street, Manchester, 4.	"Vacette"	Hand	50 W	Lightness in weight) (2½ lb)	Two crevice nozzles	Grey and maroon	£5 1 5	£0 18 7
RADIATION, LTD., (Electrical Division), 255, North Circular Road, London, N.W.10.	Parnall "Ten-ten"	Cylinder	500 W	Unusual design, portability, "Vibra-Beater" carpet cleaning attachment	Full set brushes and nozzles	Green, cream and gold	£24 0 0	£4 10 0
REELEK APPLIANCES, LTD., Skimpot Industrial Estate, Luton, Beds.	C.350 De-Luxe	Cylinder	350 W	—	Brush, nozzle and carpet attachment	Two-tone brown enamel	£14 0 0	£2 10 6
	C.300 Standard	Cylinder	300 W	—	Brush, nozzle and carpet attachment	Two-tone brown enamel	£12 0 0	£2 3 4
	C.180 Junior	Cylinder	180 W	—	Brush	Two-tone brown enamel	£9 10 0	£1 14 3
	OB.1024 Vertical	Upright	180 W	—	Full set brushes and nozzles	Two-tone brown enamel	£15 16 8 plus £3 0 0 (accessories)	£2 17 2 plus £0 4 9 (accessories)



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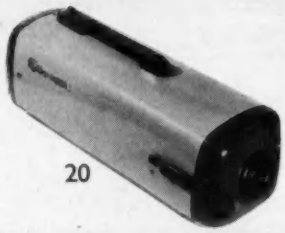

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18. *Water Softener "Jiffextra" dual-purpose cleaner*
19. *Wholesale Fittings Co. "Alto-Bag" upright cleaner*
20. *Siroma model 900 cleaner*

Manufacturer	Name or Model	Type	Motor	Special Features	Accessories	Finish	Price (excl. tax)	Purchase Tax
SIROMA ENGINEERING CO., LTD., North Acton Road, Harlesden, N.W.10.	"Siroma" 1022	Hand	160 W	Slide action switch, simple dust bag release, T.V. suppressed	Ext. tube, brush, nozzle, crevice tool	Stoved enamelled mist blue and brown	£6 15 0	£2 14 8
	OB1020	Upright	275 W	Slide action switch. Radio and T.V. suppressed	Full set brushes and nozzles	Stoved enamelled biscuit and brown	£12 17 6 £3 0 0 (accessories)	£2 7 1 £0 4 10 (accessories)
	400	Cylinder	250 W	Mounted on runners. R./T.V. suppressed. Neat nest handle	2 ext. tubes, oval brush, carpet nozzle, crevice tool	Maroon end covers, grey leathercloth cylinder	£8 17 6	£1 12 5
	500	Cylinder	250 W	Mounted on wheels and dome. R./T.V. suppressed. Neat nest handle	2 ext. tubes, oval brush, carpet nozzle, crevice tool	Nickel plated end covers, black leathercloth cylinder	£9 1 6	£1 13 2
	600	Cylinder	250 W	Mounted on tubular runners, toe-action switch. R./T.V. suppressed	2 ext. tubes, oval brush, carpet nozzle, upholstery nozzle, round brush, crevice tool	Stove enamelled beige and bracken	£9 16 6	£1 15 11
	700	Cylinder	350 W	Mounted on tubular runners, toe-action switch. Disposable dustbags, R./T.V. suppressed	2 ext. tubes, oval brush, round brush, upholstery nozzle, reversible swivel nozzle, large crevice tool	Green leathercloth cylinder. Stove enamelled green end covers	£12 9 6	£2 5 7
	800	Cylinder	350 W	Tubular runners, toe-action switch, disposable dustbags, R./T.V. suppressed	2 ext. tubes, oval brush, round brush, upholstery nozzle, reversible swivel nozzle, large crevice tool	Red leathercloth cylinder, end covers and fittings chromium plated	£13 8 0	£2 9 0
	900	Cylinder	350 W	Square shaped cylinder runners, stands erect for easy storage, disposable dustbags. R./T.V. suppressed	2 ext. tubes, round brush, upholstery nozzle, large crevice tool, combined P.V.C. swivel and floor brush	Stove enamelled two-tone grey	£11 10 9	£2 2 3
ALBERT TAYLOR (MANCHESTER), LTD., Quay Street, Manchester, 3.	"Compet Major"	Upright	275 W	—	Full set brushes and nozzles	Grey anodised, black bag	£12 17 10 £3 0 0 (accessories)	£2 7 2 £0 8 9 (accessories)
	"Compet Senior"	Cylinder	350 W	Swivelled hose	Full set brushes and nozzles	Leatherette body, chromium ends	£12 1 5	£2 4 1
	"Compet Junior"	Cylinder	250 W	—	1 brush, 2 nozzles	Leatherette body, polished metal ends	£8 16 9	£1 12 3
	"Compet Handy"	Hand	160 W	Lightweight	1 brush, 2 nozzles	Two-tone grey, black bag	£6 15 0	£1 4 8
TELLUS SUPER VACUUM CLEANER, LTD., 39, Sheen Lane, Mortlake, S.W.14.	"R.41"	Canister	250 W	Hygienic metal dust container	Full set brushes and nozzles	Polished aluminium	£24 7 6	£4 9 1
	"G.70"	Canister	450 W	Hygienic metal dust container	Full set brushes and nozzles	Polished aluminium	£30 15 6	£5 12 6

Manufacturer	Name or Model	Type	Motor	Special Features	Accessories	Finish	Price (excl. tax)	Purchase Tax
WATER SOFTENER & VACUUM CLEANER SERVICE, LTD., 248, Romford Road, Forest Gate, E.7.	"Jifextra"	Hand	180 W	Dual purpose floor cleaner and "Vacette"	Full set brushes and nozzles	Crackle stoved enamel, chromium and polished aluminium	£10 12 6	£1 17 6
WHOLESALE FITTINGS CO., LTD., 46-52, Commercial Street, London, E.1.	"Alto-Bag"	Upright	275 W	T.V. suppressed, revolving brush	Brush, nozzle and crevice tool	Cream	£12 17 6 £3 0 0 (accessories)	£2 7 1 £0 4 10 (accessories)
	"Alto-Vac"	Cylinder	250 W	T.V. suppressed	Full set brushes and nozzles	Maroon	£9 6 8	£1 14 2
	"Alto Hand Cleaner"	Hand	160 W	T.V. suppressed	Ext. tube, brush, nozzle and crevice tool	Two-tone grey	£6 15 0	£1 4 9

POLISHERS

Manufacturer	Name or Model	Type	Motor	Weight	Special Features	Finish	Price (excl. tax)	Purchase Tax
BYLOCK ELECTRIC, LTD., 109, South Street, Ponders End, Middlesex.	"532/3"	Three brush	325 W	24 lb	Incorporates scrubbers, scourers and polishers	Blue and chromium	£17 8 0	£3 3 8
	"Pacific"	Three brush	325 W	22½ lb	With suction bag	Grey and chromium	£19 8 6	£3 11 0
	"Contemporary" 325	Two brush	180 W	10 lb	Lightweight	Grey	£8 12 2	£1 11 6
COLUMBUS-DIXON, LTD., Capitol Works, Empire Way, Wembley.	"Columbus" III	Two brush suction polisher	500 W	27 lb	Attachments for vacuum cleaning, dusting, drying and scrubbing optional extras	Aluminium	£39 10 0	£7 8 2
DOWDING & PLUMMER, LTD., 2, Jakeman Walk, Birmingham, 12.	"Mypol"	Three brush	300 W	12½ lb	Clip-on polishing pads	Maroon and silver grey	£12 12 0	£2 5 6
EDMUNDSONS ELECTRICAL WHOLESALERS, LTD., 246-250, Ferndale Road, London, S.W.9.	"Summit Power Plus"	Two brush	280 W	13 lb	Attachments for waxing, polishing, scrubbing and sanding. Built-in light	Two-tone green	£14 4 0	£2 12 0
ELECTRIX, LTD., Sterling Works, Dagenham, Essex.	"Electrix"	Three brush	350 W	13¼ lb	Lightweight, foot-operated switch	Fawn and brown	£15 0 0	£2 14 10
ELECTROLUX, LTD., 153-5, Regent Street, London, W.1.	"B.9"	Three brush	250 W	19 lb	Triangular body for getting into corners. Quiet action. T.V. suppressed	Maroon and grey hammer-tone enamel	£23 7 1	£4 5 5

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21. *Electrolux model B.9 polisher*
22. *Electrix 3-brush polisher*
23. *Dowding & Plummer "Mypol" 3-brush polisher*
24. *Edmundsons "Summit Power Plus" polisher*
25. *Bylock model 532/3 3-brush polisher*

Manufacturer	Name or Model	Type	Motor	Weight	Special Features	Finish	Price (excl. tax)	Purchase Tax
ELECTROLUX, LTD., 153-5, Regent Street, London, W.1. *(continued)*	"Turbo Polisher" attachment	Single brush	—	6¼ lb	For use with "Electrolux 62" vacuum cleaner	Grey hammer-tone enamel	£7 11 5	£0 13 10
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.	"DM.342"	Two brush	270 W	15 lb	Double insulated, T.V. suppressed, automatic switching	Two-tone grey	£20 18 1	£3 16 5
HOOVER, LTD., Perivale, Greenford, Middlesex.	"Hoover" 0212A	Two brush (contra-rotating)	225 W	13 lb	Scrubbing brushes and polishing pads. Headlight	Blue and beige plastic and metal	£21 0 0	£3 18 9
LADYBIRD APPLIANCES, LTD., Reliance Works, Oxford Road, Wokingham, Berks.	"Ladybird"	Two brush	300 W	12 lb	Double insulated "Styrene" scratchproof finish	Grey	£14 14 0	£2 12 0
PHŒNIX APPLIANCES, LTD., Regina House, Marylebone Road, London, N.W.1.	"Phœnix"	Two brush	200 W	13 lb	Clip-on felt or lambswool pads available as extras	Salmon pink and mushroom	£14 4 1	£2 11 11
TELLUS SUPER VACUUM CLEANER, LTD., 39, Sheen Lane, Mortlake, S.W.14.	"Tellus"	Three brush	300 W	24 lb	Quiet action, 2 sets brushes, felt pads	Polished aluminium	£29 11 9	£5 8 2
TRICITY COOKERS, LTD., Thorn House, Upper St. Martin's Lane, London, W.C.2.	"Tricity" TP.57	Three brush suction	350 W	20 lb	Triangular head, vacuum bag, headlight. Can be used for wet scrubbing	Grey and maroon stoved enamel	£19 10 7	£3 11 5
TRUVOX, LTD., Neasden Lane, London, N.W.10.	"Juno" polisher/scourer	Single brush	250 W	16½ lb	Revolving inner brush. Polishes, buffs, sands and scours	Chromium or stoved enamel	£18 18 0 (chromium) £17 10 0 (enamelled)	£3 9 1 (chromium) £3 4 0 (enamelled)

26. *G.E.C. model DM.342 polisher*
27. *Phoenix Appliances 2-brush polisher*
28. *Truvox "Juno" polisher/scourer*
29. *Tricity suction polisher*
30. *Hoover 2-brush polisher*
31. *Tellus 3-brush polisher*
32. *Ladybird Appliances 2-brush polisher*

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NEW ELECTRICAL EQUIPMENT

Electric Skillet

A heat controlled electric skillet has recently been placed on the market by MORPHY-RICHARDS, LTD., 50, Conduit Street, London, W.1. This new cooking appliance braises, stews, fries, roasts and bakes—each at its controlled temperature level. The pan, of cast aluminium, has a cooking area of about 80 sq in and a handy reference

Morphy-Richards electric skillet

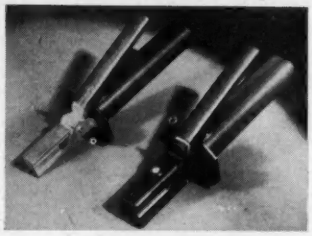
chart, showing the correct heat-control settings for various dishes, is provided on the handle. The heat control unit is fitted with a pilot light and a temperature dial ranging from 150 to 400°F. At its lowest setting the skillet can be used as a hotplate to keep food warm.

The 1,150 W element is sealed into the base of the pan. For easier lifting when the pan is full, an auxiliary handle is provided. The weight is 4 lb 12 oz and the price, including a wire baking tray and a copper-toned anodised lid, is £7 19s 6d.

Welding Electrode Holders

The two electrode holders for manual arc welding recently introduced by QUASI-ARC, LTD., Bilston, Staffordshire, the "Handicool" 600 and the "Handicool" 600 (insulated), have a shaped lever which is angled close to the handle to give better access to confined spaces. The handle and lever both have D-shaped cross-sections, providing a compact, well-balanced grip for welding in any position. The holders are designed so that they can be held with a "long" grip at the end of the handle when using high currents, or with a "short" grip close to the jaws to give a good control of the electrode tip.

The insulating material round the jaws of the fully insulated holder is non-hygroscopic, resistant to heat and fracture, and is renewable when worn. Both holders have deep-groove slots machined in the copper alloy jaws, including one along the axis of the holder to simplify overhead welding.



Quasi-Arc electrode holders

The spring, situated behind the guard, is completely protected from spatter and is insulated.

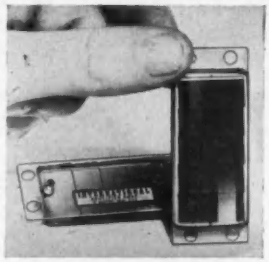
The "Handicool" 600 weighs 21 oz and the insulated version 23 oz. They are suitable for a maximum current of 600 A, and the range of electrode sizes which can be held extends from 10 s.w.g. to ⅜in.

Anti-Tracking Fluid

Added to the range of products marketed by the AMBER CHEMICAL CO., LTD., 11a, Albemarle Street, London, W.1, is an "Electrospray," composed of a silicone based anti-tracking fluid containing a rust-inhibitor and packed in an aerosol container, for use on electrical equipment where good surface insulation is required under high humidity conditions. The product has high surface resistivity, is clean, inert, water-repellent, non-inflammable and has anti-stick qualities. The aerosol pack gives a very easy form of application; one pass over the surface to be treated gives a thin, even protective film having a high degree of penetration.

Silicon Solar Cells

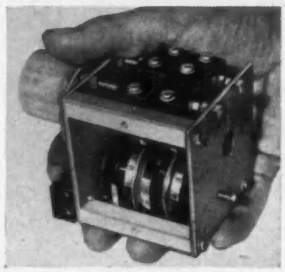
The silicon solar battery modules now available from the INTERNATIONAL RECTIFIER CO. (GREAT BRITAIN), LTD., Oxted, Surrey, are designed for powering transistorised equipment during daylight operation and for charging storage batteries for continuous day and night operation. The output voltage of the solar module is 1·75 V at 30°C cell temperature and 1·5 V at 65°C, the typical operating temperature in direct sunlight, under which conditions each module will supply a load current of approximately 35 mA. Each module contains five series-connected 1 cm by 2 cm cells embedded in a shock-resistant weatherproof epoxide moulding.



International Rectifier solar battery modules

Heavy Duty Miniature Timer

The range of miniature timing equipment manufactured by the ELECTRICAL REMOTE CONTROL CO., LTD., ElRemCo Works, Harlow New Town, Essex, is extended by the addition of the type ZX miniature cam timer which has a switching capacity of 15 A at 250 V a.c. or 3 A at 440 V a.c. The timer, which can be supplied with up to 12 changeover switches operated by continuously and independently adjustable time-setting cams, operates from a 220/250 or 400/440 V 50 c/s single-phase supply as standard,

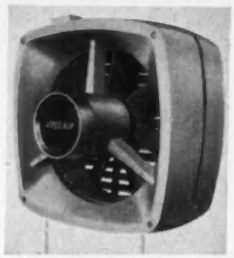


ElRemCo miniature timer

though units are available for operating on 110 V 50 or 60 c/s supplies. The timers can be supplied either unmounted or housed in sheet metal, cast aluminium, watertight or flameproof enclosures.

Window Fan

A new 12in "Xpelair" window fan has been introduced by WOODS OF COLCHESTER, LTD., Braiswick Works, Colchester. The casing, designed on clean and simple lines, is of plastic and the iris shutter vanes are of plastic material carried in a steel frame. The fan is reversible, has two-speed operation, and is capable of displacing



Woods of Colchester 12in "Xpelair" fan

60,000 cu ft of air per hour. It is suitable for mounting either in window glass or walls and the standard model is fitted with a shutter, inbuilt fan switch, and dual speed motor control. Alternatively, the fan can be supplied without shutters and without the dual speed feature. The finish is in either ivory-white or black.

Electric Hand Lamp

The latest addition to the range of hand lamps manufactured by METWAY ELECTRICAL INDUSTRIES, LTD., Canning Street, Brighton, 7, is the model 705/AW, suitable for 60 or 75 W lamps. It is fitted with a plated guard, rubber handle and an easily wired porcelain b.c. lampholder. The price is 8s 11d.

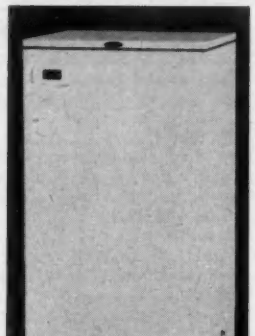
Relay Tool Kit

A relay tool kit announced by the Meter, Relay and Instrument Division of the ENGLISH ELECTRIC CO., LTD., Marconi House, Strand, London, W.C.2, consists of six tools. Two leaf-gauges are provided to determine the contact operation force in grams, giving values of two and ten grams per division, measured by the deflections of these leaves against an engraved scale. A flexible burnishing tool is attached to the contact gauge and consists of a strip of metal with a surface roughened by etching so that it has the effect of a very fine file. Abrasive material, if used, may result in the burning of contacts and the depositing of insulating particles on their surfaces.

Contact gaps can be adjusted by the spring setting tool. The contact springs are bent at their clamping point so that kinking and deformation are avoided. The kit is completed with an inspection mirror, pen torch and 2BA-OBA ring spanner.

Drying Cabinet

The "Cowie" drying cabinet, manufactured by W. A. COWIE (ELECTRICAL) CO., LTD., John Street, Warrington, Lancs., is constructed of sheet steel and stands on four castors. The overall height of the unit is 37in and it measures 20in wide by 15½in deep. Clothes to be dried are hung over wooden rails fitted across the top of the cabinet, which is heated by two 500 W sheathed elements, one of which is controlled by a switch.



"Cowie" drying cabinet (W. A. Cowie (Electrical) Co., Ltd.)

Louvres are cut in the base of the cabinet and air circulation is obtained by raising the table top off the sides of the cabinet by rubber stops. It is finished in white stoved enamel and the price is £8 7s 6d plus £1 10s 7d purchase tax in the United Kingdom.

1960 KELVINATOR REFRIGERATORS

A completely new range of refrigerators styled in the modern clean-line, or square-cut, look were introduced last week by Kelvinator, Ltd., Great West Road, Chiswick, London, W.4. It comprises cabinets of 4·6, 6, 7·7, 9·4, 13 and 18 cu ft capacities and a vertical home freezer of 10 cu ft. All are manufactured at the company's Bromborough, Cheshire, works, with the exception of the two largest models and the home freezer which are being imported from America.

The refrigerators are designed so that their doors open within the width of the cabinet, enabling them to be installed next to, or flush with, other kitchen equipment. The smallest model is the K46MT, a restyled version of the company's 4·6 cu ft table model. Then follows the K60M, a 6 cu ft refrigerator of medium size which incorporates all the features normally associated with larger cabinets.

The next model is the K77M, a "luxury" refrigerator suitable for the larger family but with an overall width of only 24in. The largest British models are the K94M, of 9·4 cu ft capacity, also with a width of 24in, and the K94MD, similar to the K94M but fitted with the "Magic Cycle" automatic de-frosting system.

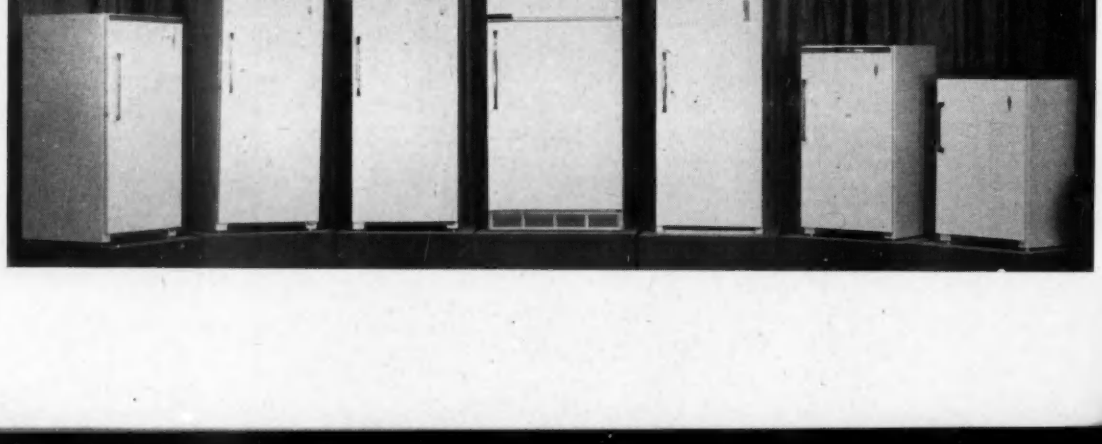
All the foregoing British models are finished in white or champagne ivory, have interior lights, plastic inner liners for easy cleaning, and ample door storage space for eggs, butter, bottles, etc. Models above 4·6 cu ft capacity are equipped with an extra-low-temperature freezer.

The American models include a two-door refrigerator-freezer of 13 cu ft capacity, the K77J-13, and the "Foodarama," which has a storage capacity of 12 cu ft and a deep freeze capacity of 6 cu ft.

The Kelvinator range is completed by the KVJ-10, a 10 cu ft domestic home freezer. This model has three fast freezing shelves as well as a refrigerated top plate.

The prices of the new models, including purchase tax in the United Kingdom, are as follows:—K46MT, £77 7s; K60M, £84; K77M, £109; K94M, £125; K94MD, £135; K77J-13, £256; KVJ-10, £164; 18 cu ft "Foodarama," £440 15s 11d.

The clean-line, square-cut look of the 1960 Kelvinator refrigerators can be clearly seen in this picture of the complete range. Left to right: Models K77M, K94M, K94MD, K77J-13, KVJ-10, K60M and K46MT



GENERATION and DEVELOPMENT

New East Midlands Grid Substation

On 26th November a new grid supply point at Calow, near Chesterfield, was officially opened by Councillor E. Greenwood, chairman of the Chesterfield Rural District Council. The substation stands on a site of about 7½ acres which allows ample room for future extensions. The present development consists of two 45 MVA 132/33 kV transformers, with associated switchgear, together with the 33 kV cables connecting the grid substation to the switch house of the Area Board. The total cost of the substation, including the associated 33 kV substation at Sheffield Road, Chesterfield, was approximately £750,000.

At a luncheon following the ceremony Mr. N. F. Marsh, chairman of the East Midlands Electricity Board, said that the new substation had been made necessary by the abnormally rapid growth of the local demand which had increased threefold in the past eleven years, from 19,000 kW to 60,000 kW. He thanked the local authorities and landowners in the district for their co-operation in granting wayleaves for the 132 kV line connecting the new point of supply with the existing grid substation at Annesley in Nottinghamshire, some 13 miles away. Mr. Marsh also mentioned the enormous difficulties of negotiating routes for overhead lines through a district which was not only highly industrialised, with complications of colliery spoil-heaps and railway embankments, but was also the centre of extensive opencast and underground coal mining. Councillor Greenwood replied to the toast of "The Local Authorities" proposed by Mr. Marsh and the Mayor of Chesterfield (Ald. J. L. Hadfield) responded to the toast of "The Guests," which was proposed by Mr. W. Warren, chief generation engineer of the East Midlands Division, Central Electricity Generating Board.

Mr. W. Warren (chief generation engineer, East Midlands Division, C.E.G.B.), Ald. J. L. Hadfield (Mayor of Chesterfield), Councillor E. Greenwood (chairman, Chesterfield R.D.C.) and Mr. N. F. Marsh (chairman, East Midlands Electricity Board) at the opening of the new grid substation at Calow, near Chesterfield

Storage Heating Systems

The Eastern Electricity Board's exhibition designed to show architects, builders and local authority members and officials electric storage heating systems made its last appearance of the year at the Board's Wood Green showroom on 24th November. On this occasion addresses were given by Mr. David Stern, a London architect, Miss M. V. Griffith, Electrical Research Association, and Mr. Leslie Shepherd, the Board's heating engineer. Mr. Stern told the audience, in which there were many borough engineers and architects from North London, that the difference in cost of installing oil-fired central heating and electric floor warming in a multi-storeyed block of flats, of which he had knowledge, was £8,000 to the advantage of electricity; it had thus been possible to afford to double-glaze all the windows and so offer ideal comfort conditions with floor warming. Miss Griffith spoke of the tests which her organisation had been making and emphasised that with electric floor warming the interior air temperature remained very constant despite variations in the floor and outside air temperatures.

Mr. Shepherd said that it was possible to provide all the hot water normally needed in a house by off-peak operation. A new combined tank installation provided 50 gallons of hot water which could be drawn off during the day; a magnetic valve ceased to be energised during on-peak periods and consequently no cold water was admitted to the hot tank during that time. The midday boost which the Eastern Board allowed for in its off-peak tariff added another 25 gallons of hot water to the store and the 75 ought to be sufficient for any household.

Towards Cleaner Air

Included in the autumn issue of *Smokeless Air*, the journal of the National Society for Clean Air (Palace Chambers, Bridge Street, London, S.W.1; 2s), are comments on the implications of the Act of 1956 and a general reference to the recent international conference (*Electrical Review*, 30th October). A weakness of the general automatic exemption of mechanical stokers from control under the Act is held to be lack of reference to widely varying inherent performances of furnaces and skill in operation. It is pointed out that whereas domestic heating appliances may be responsible for 20 per cent of the total pollution of the air they are the source of upwards of half the smoke, which (because of the high tar content and low level of emission from domestic chimneys) is far more harmful than industrial smoke. Dust from the tall chimneys of a 1,000 MW electric generating station burning 5 tons of pulverised coal per minute would be reduced, according to the Chief Alkali Inspector (Scotland), from a possible one ton per minute to 45 lb by means of electrostatic precipitators of 98 per cent efficiency (but 99 per cent is the aim).

Transformers for Thorpe Marsh

An order valued at £383,000 for two 310 MVA generator transformers, of the largest type yet ordered for the United Kingdom, has been received by the English Electric Co., Ltd., from the Central Electricity Generating Board. The transformers, each with a shipping weight of 170 tons, will be installed in the new 1,100 MW power station at Thorpe Marsh, near Doncaster. They will step up the generator voltage of 18 kV to 295 kV for transmission on the supergrid, and will be equipped with an on-load high speed tap-changer; cooling will be by pumped oil circulation through water coolers. The transformers will be manufactured at the company's Stafford works. The testing will include a full-load loss heat run.

New Seeboard Showrooms at Kingston

The development of Kingston-upon-Thames as a major shopping centre serving an ever-widening area has been rapid in recent years and the old electricity showroom opened in the High Street twenty-eight years ago became inadequate.

New premises were sought unsuccessfully for a number of years by the South Eastern Electricity Board, but opportunity came with the development of a prominent site at the junction of Eden Street with Clarence Street and on 2nd November attractive new showrooms were opened to the public. More than usual provision was made in the design of the showroom for the display of small and portable appliances and a notable feature of the first few weeks has been the high level of "cash and

The new showrooms of the South Eastern Electricity Board at Kingston

carry" sales. Illumination is by fluorescent fittings above translucent ceiling panels and ample tungsten lighting in the form of directional spots gives sparkle to the array of appliances. Heating is by off-peak floor warming. There is no permanent demonstration theatre as the open layout of the main showroom permits the floor to be cleared for special events such as the current homecraft course held in the evenings for over fifty students. There are facilities for laundry, cookery and other demonstrations.

Lyme Regis Service Centre

Speaking after the civic opening of a new electricity service centre at Lyme Regis, Dorset, on Monday last, Mr. A. N. Irens, chairman of the South Western Electricity Board, said that in the South West the task of extending the benefits of electricity as widely as possible—not least to the rural areas—was as great as anywhere in the country. The Board was connecting just over eighty new consumers every working day, and this represented a very big capital investment and called for a vigorous commercial approach by all the staff of this public enterprise. The new centre was opened by the Mayor (Alderman E. W. Grote). Mr. H. F. Castle, the Board's Crewkerne district manager, stated that electricity was booming in Lyme Regis and power sales had more than doubled since 1948. In the past three years local housewives had bought four times as many electrical appliances as they did before.

Market Heating

The central market at Nottingham has been equipped with 212 overhead radiant heaters supplied by the General Electric Co., Ltd. The heaters are on seven circuits so that when one part of the market is not in use that section can be switched off.

By-Pass Lighting

For lighting the New Ferry By-Pass, which was officially opened on Monday last by Mr. John Hay, Joint Parliamentary Secretary to the Ministry of Transport, the General Electric Co., Ltd., supplied ninety-seven Z.9455 lanterns each housing an "Osram" 140 W integral sodium lamp. The lanterns are mounted 25ft high on Stewarts & Lloyds GB.586 and GB.594 steel columns spaced at 120ft. The G.E.C. was responsible for the whole of the installation, including guard posts, bollards, pedestrian crossing beacons and cabling.

Liverpool Cathedral Floodlighting

Next Sunday the Lord Mayor of Liverpool (Alderman H. N. Bewley) is to switch on the new floodlighting installation which over the Christmas period will illuminate the 347ft high tower of Liverpool Cathedral (see *Electrical Review*, 2nd October, page 392).

Hydro-Electric Contract

The Mitchell Construction Co., Ltd., has been awarded a contract by the North of Scotland Hydro-Electric Board for the construction of the Deanie underground power station, part of the Board's Strathfarrer and Kilmorack project.

OVERSEAS

More Power for Bangkok

Mr. U. A. Johnson, the United States Ambassador, recently formally handed over the 10 MW Lumpini Park power station, Bangkok, to the Government of Thailand. The $900,000 contract to supply the diesel-alternator sets, switchgear, fusegear and transformers was placed with the English Electric Export & Trading Co., Ltd., by the General Services Administration, Washington. Each of the 12-cylinder type "V" exhaust turbo charged engines has a site rating of 1,501 b.h.p. when running at 750 r.p.m. These engines, built at Preston, are directly coupled to 1,058 kW alternators generating at 11 kV and built by the English Electric's associate company at St. Catherines, Toronto. The switchgear, motor control units, transformers and surge suppression cubicles were manufactured at Liverpool.

Official opening of Lumpini Park power station, Bangkok. In the centre is the Prime Minister of Thailand, Field Marshal Srisdi Dhanorajata, and on the extreme left the United States Ambassador, Mr. U. A. Johnson

Pemba Island's First Public Supply

The first public electricity supply for Pemba Island, part of the Zanzibar Protectorate, was switched on by the Sultan of Zanzibar on 24th November. At first power will be used mainly for domestic purposes and street lighting; applications to the clove and copra industries will follow.

Power is supplied by three 215 kW diesel engine driven sets installed at Chake Chake and is transmitted at 11 kV to the two main ports of Wete and Mkoani and the townships of Mtambile and Kengeja. The comprehensive order to supply and erect the generating plant, switchgear, transformers, transmission lines and cables was placed with the English Electric Co., Ltd., in 1958 by the Crown Agents for Overseas Governments and Administrations, acting on the recommendations of the consultants, Messrs. Preece, Cardew & Rider. British Insulated Callender's Construction Co., Ltd., supplied and installed the distribution equipment and cable work.

French Reactor Delayed

Because of difficulties encountered in the welding of the 4in thick steel pressure vessel, work on the EDF1 nuclear power reactor at Chinon will be delayed by nearly a year. The station is being erected for Electricité de France and is to have an output of 60 MW.

PARLIAMENTARY REPORT

THE main difficulty in the administration of the Atomic Energy Authority was that at present it lacked direction, said Mr. Albu during the second reading of the Atomic Energy Authority Bill. This, he added, was the result of the disillusionment occasioned by the slowing down of the progress in commercial development of reactors, both for ourselves and for export. There was now need for very firm decisions on the scope of reactor development that this country could afford to undertake. During the last year or two a large number of heads of departments in the Authority had left it voluntarily, because of frustration. There was a great anxiety that the Treasury and the accountants were frustrating the efforts of the scientists.

The Bill, which increases from 10 to 15 the maximum number of members of the Authority, excluding the chairman, was introduced by the Minister of Education, Sir David Eccles (representing the Minister for Science), who said since 1954 the work of the Authority had increased very much. One consequence of the expansion had been that the elbow room provided by the earlier provision that there must be at least seven but not more than ten was soon fully used. Sir David paid a high tribute to the work of the Authority and its members and former members. There was no other institution in this country which, in so short a space of time as five years, had done more to establish the reputation of Great Britain in the scientific age, he said. He was sorry to hear that Mr. Albu felt the organisation lacked a sense of direction. From the little which he had so far been able to learn about its current work it seemed that a great number of experiments were going on. No doubt the Board had to establish priorities, as did all boards when the business they were conducting was so extensive.

Most Opposition speakers suggested that there should be more frequent debates on the Authority.

The Bill, which also enables the Authority to include in its pensions schemes the staff of the National Institute for Research in Nuclear Science, was read a second time. Later it was read a third time and passed.

Electricity and the Landscape

Urging the Government to stimulate higher standards of siting and design within the English landscape, Mr. W. F. Deedes said that the Central Electricity Generating Board, which had in hand a vast programme of conventional and nuclear power stations and overhead lines, had the resources to set an example in creative landscape architecture. He believed that pylons worried people more than power stations, and the C.E.G.B. should be encouraged to see how far, at reasonable cost, more lower voltage lines could be placed underground—not the largest, which, as they knew, cost £300,000 a mile. It was not only the property of the C.E.G.B. which created this problem, but the proliferation of so many different lines. There should be an inquiry into the possibilities of undergrounding a proportion of these lines.

Mr. Tom Driberg asked how Mr. Deedes knew that it would cost £300,000 to put certain lines underground. Was he merely accepting credulously the figures of the C.E.G.B.? Mr. Driberg said he would like these figures to be checked by an independent surveyor. He had heard that such estimates had been carried out in certain areas by the Council for the Preservation of Rural England and other interested bodies, and they had arrived at figures substantially lower than those of the C.E.G.B.

Replying, Sir Keith Joseph, Parliamentary Secretary to the Ministry of Housing and Local Government, said research was going on into the possibility of laying power lines underground but there was absolutely no prospect of a break-through at the moment. Even if the cost were to be halved and halved again, the laying of cables underground would be four times as unsatisfactory as suspending them in the air. The routes chosen, pylon design, occasional short lengths of underground cable, and better design or concealment of transformers all mattered. He added that there were many cases recently where lines had been put underground, in the interests of landscape, despite the enormous cost.

Mr. Loveys suggested that the building of nuclear power stations need no longer be restricted to isolated areas in view of the fact that the C.E.G.B. had said that an accident similar to that at Windscale would not now be possible. In his constituency of Chichester the C.E.G.B. was making trial borings in what was not only one of the last unspoiled areas of the south coast but also agricultural land of the highest quality.

Farm Electrification

Mr. Fletcher asked the Minister of Power whether he was aware that over 5,000 farms in Devonshire were without a mains electricity supply. Mr. Wood replied that he was, but since 1948 the proportion of farms connected in the South-West had increased from about a fifth to two-thirds and in Devon from 15 per cent to over 55 per cent. Supplies to rural areas were already costing the South Western Electricity Board about £200,000 a year on revenue account. The possibility of increasing the present high rate of Area Boards' capital expenditure on rural electrification was governed by their revenue position rather than their capital allocations. Mr. Wood added that he and the South Western Board both wanted to get on with this matter as quickly as they could but the pace of advance depended on the use which was made of equipment already installed.

Radioactive Waste Disposal

The Radioactive Substances Bill received a general welcome on its second reading in the House of Lords. The Minister for Science, Lord Hailsham, introducing the Bill, said it had been made necessary partly by the large growth in the number of users of radioactive substances of one sort and another, and partly by the fact that the temporary provisions for the authorisation of disposal by the Atomic Energy Authority and by the licensed installations under the Act of 1959 would shortly come to an end.

Lord Taylor said the Bill, properly and fully implemented, would set a world pattern for radioactive waste disposal, and set it on the right lines. Lord Merrivale expressed some concern about fish which had been released in an area of the Irish Sea where radioactive waste had been deposited, and had later been found to be radioactive. Lord Hailsham, replying to this and other points on disposal at sea, said the Atomic Energy Authority had been discharging liquid radioactive effluent into the Irish Sea from Windscale since 1952 and an elaborate assay programme had been carried out. This confirmed that the present discharges were well within the zone of complete safety. It was the view of the Government, in the present state of knowledge, that controlled sea dumping of radioactive waste was the most appropriate way to dispose of certain categories, and as carried out could not create any hazard.

The British method of disposing of radioactive waste at sea also raised a question in the Commons, where Mr. Fletcher asked what steps were being taken to minimise the dangers through human consumption of fish caused by such disposal. Mr. Godber, Parliamentary Secretary, Ministry of Agriculture, Fisheries and Food, said that continuous monitoring by scientists of his Ministry and the Atomic Energy Authority showed that authorised discharges did not give rise to any risk to consumers of fish. When Mr. Fletcher pointed out that eminent European scientists were of the opinion that there should be no disposal of radioactive waste at all, Mr. Godber said that reports so far certainly did not bear out any of the fears that had been expressed.

Financial Section

STOCKS and SHARES

IN the industrial sections of the Stock Exchange, November ended with markets a good deal quieter, and the movement of prices more irregular, than they had been at the beginning. Ordinary shares seem now to be meeting with more competition, for the investor's favour, from the markets in gilt-edged stocks and industrial prior charges where, on the average, the yields are attractively higher. The difference may be exemplified by contrasting, for instance, the 5½ per cent yield from English Electric 5½ per cent debentures at par, with the return of under 4½ per cent from the same company's ordinary shares at 45s 6d. In more extreme cases, Thorn Electrical 6 per cent loan stock offers about 3½ per cent more than the 2 per cent yield on the ordinary shares; and E.M.I. 5½ per cent preference at 19s 3d give 5¾ per cent, against a prospective return of under 3 per cent on the ordinary. Between Hoover ordinary and preference issues there is a yield difference of some 2½ per cent.

Mixed Changes

Electrical shares produced a mixture of gains and losses over the week. On the favourable side, B.I.C.C. have hardened to 54s 3d since the company's announcement of increased prices for some types of cable, and in the same section Johnson & Phillips recovered to 19s 3d. English Electric at 45s 6d were supported on the news of substantial contracts. C. A. Parsons at 53s, and A. Reyrolle at 93s 3d, were each about half-a-crown better, but A.E.I. eased further to 60s. Heavy engineering shares were irregular, Richardsons Westgarth and Clarke Chapman being lower, but International Combustion up to 36s 3d. There were losses of a shilling or more in Ward & Goldstone, Westinghouse, I.C.T., and Aron Meter and improvements in Bulpitts and Marryat & Scott.

Crabtree Electrical

Quoted at about 34s before publication of the annual results about a month ago, Crabtree Electrical Industries 10s shares have since appreciated to 53s on the strength of the substantial improvement disclosed in the profits statement for 1958–59, and the subsequent indication, in the full report, of a possible scrip issue. Although net profits (after tax) were almost doubled in the twelve months to last July, the dividend was held at 20 per cent for the sixth year in succession, with almost threefold cover by earnings. In his review, the chairman reports very busy conditions in all departments. His reference to a revaluation of the assets has encouraged expectations of a scrip issue; and the contraction of the yield on the shares to only 3¾ per cent suggests market hopes that the sequel might be a more liberal distribution policy.

Berry's Electric Interim

Berry's Electric Magicoal doubled the dividend for 1958–59 and are now

Price Changes in

Company or Board	Nom. Value	Middle price 30th Nov.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1959 Highest	1959 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	81		3	3	3 14 0	81	77½
Brit. Elec. 1974/77	100	78		3	3	3 17 0	78	74½
Brit. Elec. 1976/79	100	81		3½	3½	4 6 6	81	77½
Brit. Elec. 1974/79	100	91½		4½	4½	4 12 9	91½	87½
Overseas Electric Supply								
Calcutta Elec.	£1	20/-		6·8†	7†	11 8 0	20/-	16/-
East African Power	£1	21/-		7½	8	7 12 6	22/6	19/3
Nigerian Elec.	£1	17/-	−1/-	8	8	9 8 6	18/-	13/-
Perak Hydro-Elec.	£1	14/6		10	5	6 18 0	15/-	12/3
Electrical Shares								
Aberdare Holdings	5/-	17/3	−3d	17½	17½	5 1 6	18/9	15/6
Aerialite	1/-	8/-	−3d	54	54	6 15 0	12/3	7/9
Allen, W. H.	£1	55/-	+1/3	11	12	4 7 3	55/-	43/-
Allied Insulators	5/-	23/6		—	20‡	4 5 0	23/6	18/9
Anglo-Portuguese Tel.	£1	29/-	−1/9	9	9	6 4 3	30/9	26/6
Aron Elec. Ord.	£1	45/-	−1/3	15	15	6 13 3	62/6	45/-
Assoc. Elec. Ord.	£1	60/-	−1/3	15	15	5 0 0	67/-	53/9
Automatic Tel. & El.	£1	81/3		17	17‡	4 3 9	82/6	71/3
Babcock & Wilcox	£1	43/6		13½	13	5 19 3	52/6	43/-
Bakelite	10/-	38/9		15	15	3 17 6	40/-	22/-
Baldwin, H. J.	2/-	2/6		20	—	—	3/-	2/-
Berry's Electric	5/-	33/-	+2/6	10	20‡*	3 0 6	33/-	7/3
Bowthorpe Holdings	2/-	10/3		25	27	3 3 6*	10/9	8/-
British Elec. Traction: Def. Ord. "A"	5/-	45/6		25	35	3 17 0	47/6	35/6
B.I. Callender's	£1	54/3	+1/9	12½	13½	4 19 9	58/6	44/9
B.I. Callender's 6% Pref.	£1	21/-		6	6	5 14 3	21/-	19/9
British Thermostat	5/-	22/6	−6d	30	35	3 17 9*	28/-	18/6
British Vac. Cleaner	5/-	12/3	−3d	10	7½*	3 1 6	12/6	4/6
Brook Motors	10/-	58/6		25	24½*	4 2 6	59/6	46/-
Bulgin, A. F.	1/-	11/6		45	50	4 7 0	11/6	6/9
Bulpitts	5/-	19/3	+9d	—	15	3 18 0	19/6	10/-
Burco Dean	5/-	19/6		22½	16*	4 2 0	19/6	12/3
Cable & Wireless: Ord.	5/-	18/-	−6d	10	10*	2 15 6	18/6	12/3
4% Loan	100	96		4	4	4 3 3	96	93
Chloride El. Storage "A"	£1	65/6		17½	20‡	4 1 6*	72/-	43/8
Clarke Chapman	£1	53/-	−3/3	27½	13¾*	5 3 9	66/3	52/6
Cole, E. K.	5/-	25/-	−6d	17½	20	4 0 0	25/6	17/3
Contactor Switchgear	5/-	14/9		14	14	4 15 0	16/9	12/-
Cossor, A. C.	5/-	7/3		Nil	5	3 9 0	9/-	6/3
Crabtree	10/-	53/-	+6/9	20	20	3 15 6	54/-	28/-
Crompton Parkinson	5/-	17/3	+3d	12	14	4 1 3	19/-	11/9
Davis & Timmins	5/-	21/9	−3d	18	20	4 12 0	22/-	14/6
De La Rue	10/-	65/6	+1/6	17½	20	3 1 0	66/-	30/3
Decca "A"	10/-	42/6*		43¾	50	4 14 3*	44/3	33/3
Desoutter	5/-	31/9	+9d	25	21¾*	3 8 6	31/9	19/-
Dewhurst	2/-	9/3	−3d	20	20	4 6 6	9/6	7/3
Dictograph Tel.	2/-	10/6	+6d	20	20	3 16 3	10/6	7/-
Dubilier Condenser	1/-	5/3		20	25	4 15 3	5/6	3/3
Duport	5/-	21/9	+3d	12½	17½	4 0 6	21/9	10/3
E.M.I.	10/-	77/-	−6d	15	20*	2 12 0	81/-	48/-
Electrical Apparatus	5/-	14/-	+6d	14½	14½	5 3 0	16/6	13/-
Electrical Components	5/-	13/9		12½	15	3 12 9*	14/-	7/-
Elec. Construction	£1	35/-		8½	9	5 2 9	37/-	27/9
Elliott-Automation	5/-	28/-		—	10‡	—	30/6	16/9
English Electric	£1	45/6	+1/3	14	14	4 2 6*	48/9	37/10
English Electric 3½% Pref.	£1	13/6		3½	3½	5 11 0	13/6	12/3
Ericsson Tel.	5/-	25/6	−1/6	12†	13†	4 3 6	28/-	22/3
Ever Ready	5/-	24/3	−9d	20	27½‡	3 8 3*	28/-	13/3
Falk Stadelmann	£1	34/6	−1/-	10	10	5 16 0	35/6	25/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

doubling also the interim payment on account of the current year, ending in March. This announcement was not unexpected by the market in view of earlier statements from the company at the time of the 50 per cent scrip issue and the annual meeting last August. Sales were then said to have reached record levels in the first quarter of the year now running, and prospects for the rest of the period were described as extremely favourable.

Electrical Investments

Company or Board	Nom. Value	Middle Price 30th Nov.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1959 Highest	1959 Lowest
Electrical Shares—continued								
G.E.C.	£1	44/-	+6d	10	10	4 11 0	48/-	31/3
G.E.C. 6½% Pref.	£1	23/-		6½	6½	5 13 0	23/-	20/3
General Cables	5/-	9/-		24	15	8 6 9	9/3	7/6
Greenwood & Batley	£1	116/3	+1/3	20	20	5 3 3	117/6	75/-
Hackbridge Holdings	5/-	15/9	+3d	20	20	6 7 0	19/3	14/3
Hackbridge & Hewittic	5/-	14/6	+6d	20	20	5 3 6*	15/6	10/6
Head Wrightson	5/-	22/6	−9d	20	14‡*	3 2 3	26/-	16/6
Heatrae	2/-	9/6		20	20	4 4 3	10/-	7/6
Holophane	5/-	19/-	−6d	22½	26	6 16 9	20/-	14/9
Hoover	5/-	96/9	+9d	50	60	3 2 0	98/9	55/-
I.C.I.	£1	55/-	−6d	12	8*	2 18 6	58/9	33/-
Intl. Combustion	5/-	36/3	+1/3	25	30‡	4 2 9	38/6	29/9
Intl. Computers & T.	£1	72/6	−1/3	—	8‡	2 4 0	78/9	57/6
Johnson & Phillips	£1	19/3	+6d	5	5	5 4 0	30/6	18/3
Lancashire Dynamo	£1	47/6		11	12½‡	3 19 0*	48/9	31/6
Laurence Scott	5/-	18/-	−9d	15	15	3 11 6*	18/9	14/-
Lister, R. A.	£1	48/6		10	12½	5 3 0	50/6	32/9
Lucas, J.	£1	65/3		10	12½	3 18 6	70/-	43/3
Marconi Marine	£1	42/-		10	10	4 15 3	48/6	40/-
Marryat & Scott	2/-	12/6	+9d	37½	22½*	3 12 0	12/6	8/6
Mather & Platt	£1	50/-		15	10‡*	4 5 6	51/6	41/3
Metal Industries	£1	68/9	+1/9	14	14	4 1 6	68/9	39/9
Midland Elec. Mfg.	£1	48/9		12½	10*	4 2 0	48/9	41/6
Morphy-Richards	4/-	32/6		20	25	3 1 6	34/-	18/-
Murex	£1	63/9	+1/3	17½	15	4 14 0	63/9	42/-
Newman Ind.	2/-	3/6		10	10	5 14 3	3/6	2/3
Oldham & Son	1/-	3/-		17½	17½	5 16 9	3/3	2/6
Parsons, C. A.	£1	53/-	+2/6	7½	8½‡	3 1 0	58/-	45/9
Philips' Lamps	Fl.10	138/9		14	14	1 18 0	139/6	88/-
Plessey	10/-	42/6	−6d	20	13*	3 1 3	46/3	23/6
Pye	5/-	20/9	−3d	12½	12½	3 0 3	22/6	13/9
Pyrotenax	5/-	47/-	−6d	—	34	3 12 6	47/6	33/9
Reliance Clifton	5/-	22/6		15	15	3 6 9	24/6	17/6
Reyrolle	£1	93/3	+2/6	17½	17½	3 15 0	98/-	85/9
Rheostatic	4/-	12/6	+6d	12½	12½	4 0 0	12/6	8/3
Richardsons Westgarth	10/-	11/6	−6d	8½	8½	7 5 0	15/3	11/6
Simon-Carves	5/-	30/-	+1/-	25	25	4 3 3	32/-	28/6
Smith (England), S.	4/-	18/3	−6d	12½	17½	3 16 9	21/-	11/6
Southern Areas	£1	14/6		Nil	Nil	Nil	15/-	10/6
Strand Elec.	5/-	17/9		15	20	5 12 9	18/-	8/6
Sturtevant	5/-	22/6	−1/-	15†	15†	5 9 0	23/6	17/-
Sun Elec.	5/-	16/-	−3d	25	15*	4 13 9	16/9	8/3
Switchgear & Cowans	5/-	15/6	−3d	22½	15*	4 16 9	16/-	10/3
T.C.C.	10/-	57/6		25	25	4 7 0	58/6	38/-
Telephone Mfg.	5/-	7/-		10	10	7 2 9	7/3	4/9
Telephone Rentals	5/-	19/6	−6d	12½	12½*	3 4 0	22/6	11/9
Thompson (John)	5/-	20/-		25	25	6 5 0	25/6	19/6
Thorn Elec.	5/-	48/9		17½	20	2 1 0	50/-	26/3
Thornycroft	£1	21/3		7½	6	5 13 0	30/-	20/6
Tube Investments	£1	120/-		17½	20	3 6 9	120/-	71/6
Vactric	5/-	42/6	−6d	25	37½	4 8 3	46/6	26/3
Veritys	5/-	1/6		12½	2½	—	5/-	1/3
Walsall Conduits	4/-	14/9		22½	22½	3 9 3*	15/3	10/8
Ward & Goldstone	5/-	56/6	−1/-	25	30	2 13 0	57/6	30/6
Watford	2/-	12/-	−9d	25	25*	4 3 3	14/9	7/6
Westinghouse	£1	50/6	−1/3	10	10	3 19 3	53/9	39/6
West, Allen	5/-	14/3	−3d	12½	11⅝*	4 0 6	14/6	11/9
Wolf Electric	5/-	9/3		10	10	5 8 0	9/9	7/9

The directors hoped to be able at least to maintain the rate of the ordinary dividend at 20 per cent, as before, on the increased capital. On that basis, the yield on the 4s shares, which rose 2s 6d to 33s, will be 3 per cent.

Ether Merger

The 5s shares of Ether, Ltd., have been dealt in actively since their introduction to the market about the middle of this year, and have been quoted at about 26s since the announcement of negotiations for the acquisition of the capital of the J. Langham Thompson Group, the designers and makers of scientific instruments and electronic equipment. Ether are to make a "rights" issue of 672,660 new shares at 20s to provide the cash part of the consideration and further resources. Allotment letters are expected to go out next week. Two interim dividends totalling 10 per cent have been declared this year on the present capital of £250,000, and a final of 5 per cent on the increased capital is forecast. Turnover and profits of Langham Thompson are stated to be commensurate with those of Ether, who hope to be able to recommend dividends of at least 17½ per cent for the period 1959–60.

Duport Dividend

The 5s shares of Duport, Ltd., have been well supported, up to 21s 9d, since the publication of the full report, in which the chairman described the outlook for the present year as set fair: output from most of the plants was at record levels, and sales were good in all departments. For the year ended last July, net profits expanded (despite a larger tax charge) by more than a half, to just over the million mark, and provided amply for an increase in the dividend from 12½ to 17½ per cent. The new rate is paid from earnings equivalent to about 44 per cent on the ordinary capital of £3¾ million, and produces a yield of 4 per cent on the shares at their present price. Last year the financial resources were fortified by an issue of £2 million debenture stock.

Sun Electrical

There has been a considerably freer market in the shares of the Sun Electrical Co. since this year's capital rearrangement, which included a 100 per cent ordinary scrip issue and the division of the former £1 shares into units of 5s. Allowing for these changes, the present price of about 16s is approximately double the figure quoted at the beginning of the year. Recently the company has declared a final dividend bringing the total for 1958–59 to 15 per cent on the capital of £193,000, and representing an improvement of 2½ per cent on the previous payment. With net profits (after tax) little changed at £61,000, the new rate appeared from the preliminary statement to be covered approximately three times over. The yield has improved to a fraction under 4¾ per cent.

REPORTS and DIVIDENDS

Crabtree Electrical Industries, Ltd.—The main figures in the accounts for the year to 31st July last were given in our issue of 6th November. In his circulated statement, Mr. J. A. Crabtree (chairman) says that the entire outlook of the building trade changed for the better during the past year, and as a result the board is now able to present greatly improved results for the year under review. Probably the most interesting development during the year was the acquisition of C. M. Churchouse, Ltd., who manufacture lighting fittings, and their wholly owned subsidiary, Robbins & Bradley, Ltd., who make lighting fittings and accessories for the lighting fittings trade. During the year they introduced several new products which are making headway, including a range of 60 A motor starters and triple pole circuit-breakers. The smaller circuit-breakers referred to in last year's review are being specified more frequently and (together with the earth leakage patterns which have been very successful) are now establishing themselves in the circuit-breaker market. The board considers the present time opportune to re-value the assets, and following the completion of this valuation, it will consider bringing the nominal issued capital of the company more into line with the capital actually employed in the business.

The Hawker Siddeley Group, Ltd., reports trading profits of the United Kingdom group for the year to 31st July last of £5,985,926, as compared with £5,688,201 for the preceding year, and trading profits of the Canadian group of £3,910,726 (against £6,616,689). After meeting all charges, including £3,091,301 for United Kingdom taxation and £2,057,741 for Canadian taxation, the net profit attributable to the parent company is £6,250,957 (against £5,118,601), of which £3,962,708 is retained in subsidiary companies. The dividend for the year is maintained at 10 per cent by a final payment of 7 per cent.

Aberdare Cables Africa, Ltd.—After providing £16,415 for taxation, the net profit for the year to 30th June last is £26,890, as compared with £44,522 for the previous year. The ordinary dividend for the year is maintained at 7½ per cent, general reserve receives £2,580 and the balance carried forward is £4,176 (against £2,111 brought in).

Sterling Electric Holdings, Ltd., reports that after providing £20,336 for taxation the group net profits for the year ended 31st March last are £32,545, as compared with £39,944 for the preceding year. The ordinary dividend for the year is unchanged at 15 per cent.

Duport, Ltd.—In reviewing the activities of the various divisions of the group, which includes the Revo Electric Co., Ltd., and Teledictor, Ltd., during the year ended 31st July last, Mr. W. L. Barrows (chairman) says that as a result of the reorganisation the trading results of the Electrical Division were more satisfactory, but the process of bringing this Division to a suitable profitable basis is taking longer than anticipated.

Courtney, Pope (Electrical), Ltd.—The group net profit for the year to 31st May last is £91,909, as compared with £67,621 for the preceding year. Taxation absorbed £78,212. It is proposed to pay a final dividend of 30 per cent and a bonus of 5 per cent, making 45 per cent for the year (against 40 per cent). It is also proposed to make a one-for-one scrip issue.

Berry's Electric Magicoal, Ltd., is paying an interim dividend of 6⅔ per cent (against an equivalent of 3⅓ per cent after allowing for a scrip issue).

Johnson, Matthey & Co., Ltd., have declared an interim dividend of 3 per cent (against an equivalent of 2 per cent after allowing for a scrip issue).

Ada (Halifax), Ltd., announces an interim dividend of 10 per cent (unchanged) on capital increased by other than a scrip issue.

The London Electrical & General Trust, Ltd., is paying an interim dividend of 6 per cent (against 4 per cent). The increase does not indicate a higher total.

The Lisbon Electric Tramways, Ltd., is paying an interim dividend of 2 per cent, tax free (unchanged).

Worthington-Simpson, Ltd., has announced an interim dividend of 7½ per cent (unchanged).

Increases of Capital

Veritys (Maxlume), Ltd.—Increased by £99,900, in £1 ordinary shares, beyond the registered capital of £100.

Electro Furnace Products, Ltd.—Increased by £100,000 in 50,000 "A" ordinary £1 shares and 50,000 "B" ordinary £1 shares, beyond the registered capital of £400,000.

J. Walton (Electrical), Ltd.—Increased by £25,000, in £1 ordinary shares, beyond the registered capital of £25,000.

R. M. Catterson-Smith, Ltd.—Increased by £10,000, in £1 ordinary shares, beyond the registered capital of £10,000.

New Companies

BICC-Burndy, Ltd. — Registered 17th November. Capital £250,000. To adopt an agreement dated 30th September, 1959, between the Burndy Corporation and British Insulated Callender's Cables, Ltd., and to carry on the business of manufacturers of and dealers in all kinds of electrical accessories, etc. Solicitor: E. J. Gibbons, Surrey House, Temple Place, W.C.2.

Theta Controls, Ltd.—Registered 13th November. Capital £100. Electrical, mechanical and general engineers, manufacturers of and dealers in electrical apparatus, etc. Regd. office: 47, Cannon Street, E.C.4.

A. E. Crowson, Ltd.—Registered 13th November. Capital £2,000. Electricians, mechanical engineers, manufacturers of and dealers in electrical apparatus, etc. Directors: Mrs. Lily Crowson and E. Pitts. Regd. office: 144, Abington Avenue, Northampton.

F. A. Leeming, Ltd.—Registered 11th November. Capital £3,000. Manufacturers of and distributors of, agents for and wholesale and retail dealers in electrical goods of all kinds, radio and television receivers, etc. Directors: G. E. Neesam and Mrs. Phyllis Neesam. Regd. office: National Employees House, Quebec Street, Leeds, 1.

Electric Services (Bristol), Ltd.—Registered 3rd November. Capital £5,000. To acquire the business of electrical engineers carried on at The Square, Timsbury, Som., as Electric Services, etc. Directors: D. H. Jones and B. W. C. Venn. Solicitors: Netcott, Barnett & Leonard, Bristol.

G. F. Baker (Electrical), Ltd.—Registered 5th November. Capital £5,000. Electrical engineers, etc. Directors: G. F. Baker and Bessie Baker. Regd. office: Market Place, Easingwold, Yorks.

Capacitors & Resistances (London), Ltd.—Registered 6th November. Capital £100. Manufacturers of and dealers in electric condensers and resistances, etc. Solicitors: Lovell White & King, 1, Serjeant's Inn, Fleet Street, E.C.4.

Newby & Tuck, Ltd.—Registered 4th November. Capital £2,000. Electrical engineers, etc. Directors: D. P. Newby, P. C. Tuck and D. J. Bennett. Regd. office: Spurlings Yard, Wallington, Fareham.

Bankruptcies

C. F. Thompson, lately carrying on business at 8, Victoria Road, Rushden, and at 16, Denmark Road, Rushden, Northants., electrical engineer.—Receiving order made 17th November on debtor's own petition.

G. B. Barnes, 23, Front Street, Brampton, Cumberland, trading as A.B.C. Electrical Co., radio and electrical engineer.—Last day for receiving proofs for dividend 5th December. Trustee, Mr. D. Atkinson, Official Receiver, 14, Lowther Street, Carlisle.

G. H. Collins, lately carrying on business at Astoria Buildings, Brighouse, Yorks., electrical engineer.—Last day for receiving proofs for dividend 5th December. Trustee, Mr. J. L. Williams, 20, North Parade, Bradford, 1, Official Receiver.

J. E. Woodcock, lately carrying on business at 85, Pershore Road South, King's Norton, Birmingham, under the style of Industrial Maintenance and Power Service, electrical contractor.—First and final dividend of 1s 6d in the £, payable on and after 9th December at the Official Receiver's office, Somerset House, 37, Temple Street, Birmingham, 2.

S. Ross, a partner in the firm of Jif Electrical Appliances, 1, Clevedon Street, Stoke Newington, London, N.16, electrical dealer, and lately carrying on business at 98, Mathias Road, Stoke Newington, N.16.—Receiving order made 19th November on a creditor's petition.

R. C. Matthews, 45, Station Road, Seaham Harbour, Durham, cycle and electrical dealer.—Trustee, Mr. E. Taylor, 30-32, Grey Street, Newcastle-upon-Tyne, appointed 19th November.

N. Sherman and **B. Bercovici,** lately trading together as B.B. Radio and Television Service, and B.B. Radio at 168, Roman Road, London, E.2, radio, television and electrical equipment dealers. Also separate estate of B. Bercovici.—Last day for receiving proofs for dividend 10th December. Trustee, Mr. A. W. Hunter, Walter House, 418-422, Strand, London, W.C.2.

F. J. Crutchley, 9, York Street, Hulme, Manchester, and previously trading at 304, Deansgate, Manchester, electrical engineer.—Last day for receiving proofs for dividend 8th December. Trustee, Mr. W. H. Meredith, 20, Byrom Street, Manchester, 3, Official Receiver.

P. J. Elworthy, 128, Cowick Street, St. Thomas, Exeter, radio, television and electrical engineer.—First and final dividend of 3s 7¼d in the £, payable from today (Friday), at 17, Southernhay West, Exeter.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

MONDAY, 7th DECEMBER

Birmingham.—College of Technology, 6 p.m. I.E.E. South Midland Centre. "Some Industrial Applications of Electro Heat," by E. May.

Bolton.—Railway Hotel, Trinity Street, 7.45 p.m. A.S.E.E. Bolton Branch. "Medium Voltage Distribution Gear: Current Practice and Future Trends," by W. Harding.

Bournemouth.—Grand Hotel, Firvale Road, 8 p.m. A.S.E.E. Bournemouth and District Branch. Films evening.

Cambridge.—Technical College, 6.30 p.m. I.E.E. East Anglian Sub-Centre. "Rockets and Satellites," by Dr. R. L. F. Boyd.

Gloucester.—Technical College, 6 p.m. I.E.E. Western Centre. "The Influence of Consumers' Load/Consumption Characteristics on Metering Practice," by L. B. S. Golds.

Ilford.—Angel Hotel, 8 p.m. A.S.E.E. Essex Branch. "Mineral Insulated Cables—Latest Applications," by H. W. M. Parker.

Ipswich.—Ipswich and District Electrical Association, 7.15 p.m. Film show, followed by supper.

Leeds.—At the British Lighting Council, 24, Aire Street, 6.15 p.m. I.E.S. Leeds Centre. "The Next Fifty Years of Lighting Development," by R. T. O. Freeth.

Liverpool.—At the Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey and North Wales Centre. "The Deltic Locomotive," by C. M. Cock.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Electronics and Communications Section. "Frequency Patterns for Multiple-Radio-Channel Routes," by B. B. Jacobsen.

Maidstone.—Technical College, 6.30 p.m. I.E.E. district meeting. "An Analytical Approach to Industrial Lighting," by W. Imre-Smith.

Manchester.—Chorlton Town Hall, All Saints. Women's Engineering Society, Manchester Branch. "An Electrical Engineer looks at Russia and America," by H. West.

Newcastle-on-Tyne.—Rutherford College of Technology, 6.15 p.m. I.E.E. North Eastern Measurement and Electronics Group. "Dielectric Materials—Trends and Prospects," by C. G. Garton.

County Hotel, Neville Street, 6.30 p.m. North East Electrical Club. "A Peep Beyond the Iron Curtain," by W. H. Lythgoe.

TUESDAY, 8th DECEMBER

Belfast.—David Keir Building, Queen's University, Stranmillis Road, 6.30 p.m. I.E.E. Northern Ireland Centre. "The Linear Induction Motor," by E. R. Laithwaite.

Bradford.—Y.E.B. Offices, Sunbridge Road, 7 p.m. I.E.E. North Midland Graduate and Student Section. "Instrumentation," by P. N. Baker and D. B. Copley.

Cambridge.—Cavendish Laboratory, Free School Lane, 8 p.m. I.E.E. Cambridge Electronics and Communications Group. "The Reliability of Components," by G. W. A. Dummer.

Chelmsford.—Electricity Showrooms, 7 p.m. I.E.E. London Graduate and Student Section. District meeting. "The Bond Disc with Particular Reference to the F.M. Regulator," by S. J. Read.

Chester.—Westminster Hotel, City Road, 7.45 p.m. A.S.E.E. Chester and District Branch. "The Application of Electricity in Oil Refining," by S. York.

Coventry.—Hotel Leofric, 7.30 p.m. Institution of Plant Engineers, Birmingham Branch. "The Safe Use of Electricity in Factories," by G. L. Leighton.

Eltham.—Eltham Green School, Queenscroft Road, 7.45 p.m. A.S.E.E. South East London Branch. "The Work of the A.S.E.E.", by E. A. Bromfield.

Glasgow.—Kenilworth Hotel, Queen's Street, 8 p.m. A.S.E.E. Glasgow Branch. Colour film of the 1959 Electrical Engineers (A.S.E.E.) Exhibition.

London.—Connaught Rooms, W.C.2, 12.30 for 1 p.m. Electrical Industries Club. Christmas luncheon.

At the Federation of British Industries, Tothill Street, S.W.1, 6 p.m. Illuminating Engineering Society. "Lighting of Drawing Offices," by J. B. Collins and F. G. Langdon.

Manchester.—Central Library, St. Peter's Square, 6.45 p.m. Society of Instrument Technology, Manchester Section. "Instrumentation of the Dounreay Reactor," by K. R. Sandiford.

Engineers' Club, Albert Square, 7.15 p.m. Institution of Plant Engineers, Manchester Branch. "Generation of Electrical Power from Nuclear Sources," by W. G. Busbridge.

Portsmouth.—Offices of the Ministry of Labour and National Service, Lake Road, 7.30 p.m. A.S.E.E. Portsmouth and District Branch. "Electric Underfloor Heating," by R. Siverns.

Rugby.—College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Graduate and Student Section. "High Power Valve Life Testing," by H. C. Burford.

York.—Georgian House, Blossom Street, 7.30 p.m. A.S.E.E. York Branch. "Modern Electric Motor Specification," by J. Spence.

WEDNESDAY, 9th DECEMBER

Bath.—Pump Room. I.E.E. Bristol Graduate and Student Section. Discussion on "Training and Recruitment for the Electrical Engineering Profession," opened by Prof. G. H. Rawcliffe and R. G. Bellamy.

Birmingham.—James Watt Memorial Institute, 6.30 p.m. I.E.E. South Midland Graduate and Student Section. "Fundamentals of A.C. Traction Rectifier Equipment," by K. Gunary.

Engineering Centre, Stephenson Place, 7.30 p.m. A.S.E.E. Birmingham Branch. Film show.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply Section. "Field Suppression of Turbo-Alternators," by J. R. Hill, A. Hunt, W. J. Joyce and D. H. Tompsett.

Savoy Hotel, W.C.2, 7.15 for 7.45 p.m. Association of Short-Circuit Testing Authorities. 21st Anniversary dinner.

1, Birdcage Walk, Westminster, S.W.1. Institution of Mechanical Engineers, Steam Group. "The Design and Construction of Power Station Feed Heaters," by J. V. Bigg, and "Flash Evaporators for the Distillation of Sea Water," by A. Frankel.

Manchester. — Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North Western Electronics and Communications Group. "New Amplifying Techniques," by C. W. Oatley.

Electricity Showrooms, N.W.E.B., St. Peter's Square, 7 p.m. I.E.E. North Western Graduate and Student Section. "Domestic Electricity," by D. Hardy.

Newport (Mon.).—King's Head Hotel, 6.30 p.m. Newport and District Electric Club. "Recent Practical Developments in Lighting," by V. G. Wackrow.

Northampton.—Room B16, College of Technology, 7.15 p.m. Northampton and District Electrical Association. "Discharge Lamp Design," by R. F. Weston.

Nottingham. — County Hotel, Theatre Square, 7 p.m. Institution of Plant Engineers, East Midlands Branch. "Education and Technology in Russia," by I. G. Slater.

Preston.—North Western Electricity Board Theatre, Friargate, 7.15 p.m. I.E.E. North Lancashire Sub-Centre. "Subscriber Trunk Dialling," by D. A. Barron.

THURSDAY, 10th DECEMBER

Bradford.—Midland Hotel, 7.30 p.m. A.S.E.E. Bradford and District Branch. "Relays and Auto-Control in Industry," by Dr. W. L. Stern.

Chester.—"The Blossoms," 7.15 p.m. Institution of Plant Engineers, Merseyside and North Wales Branch. "Electrical Regulations," by D. A. Picken.

Christchurch.—King's Arms Hotel, 6.30 p.m. I.E.E. Southern Centre. "The Transmission of News Film over the Transatlantic Cable," by C. B. B. Wood and I. J. Shelley.

Dublin.—Physical Laboratory, Trinity College, 6 p.m. I.E.E. Irish Branch. "Safety and Accidents in Electrical Supply," by C. B. H. McQuillan and R. A. H. Jackson.

Dundee.—Electrical Engineering Department, Queen's College, 7 p.m. I.E.E. North Scotland Sub-Centre. "Automatic Digital Recording of Experimental Values," by W. H. P. Leslie.

Glasgow.—Scottish Building Centre, 7.15 p.m. Institution of Plant Engineers, Glasgow Branch. "Automatic Controls for Coal Fired Shell Type Boilers," by P. J. Turner.

Hull.—Y.E.B. Offices, Ferensway, 6.30 p.m. I.E.E. North Midland Centre. Chairman's address, by Prof. G. W. Carter.

Liverpool. — M.A.N.W.E.B. Industrial Development Centre, Paradise Street, 7.15 p.m. Society of Instrument Technology, Liverpool Section. "New Simple Transistorised Industrial Instruments," by A. Green.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Utilisation Section. "The Characteristics and Protection of Semiconductor Rectifiers," by D. B. Corbyn and N. L. Potter.

At the Royal Institution, Albemarle Street, W.1, 6.30 p.m. Institution of Production Engineers. "Production Engineering Developments in Russia," by Dr. D. F. Galloway.

London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers. "The Simulation of Nuclear Reactors and Power Plants," by W. J. G. Cox and J. Dowsing.

Manchester. — Demonstration Theatre, Town Hall Extension, 6 p.m. I.E.S. Manchester Centre. "Road Surface Illuminants in the Practice of Public Lighting," by J. B. de Boer.

Swansea.—Conference Room, S.W.E.B. Showrooms, Kingsway, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. "Lighting and Architecture," by J. M. Waldram.

Wimbledon.—Prince of Wales Hotel, 7.45 p.m. A.S.E.E. South West London Branch. "Modern Fire-Fighting Electrical Hazards."

FRIDAY, 11th DECEMBER

Aberdeen.—Robert Gordon's Technical College, 7.30 p.m. I.E.E. North Scotland Sub-Centre. "Automatic Digital Recording of Experimental Values," by W. H. P. Leslie.

Leicester.—College of Technology, 7 p.m. I.E.E. East Midland Centre. "Electrical Floor Warming," by J. W. Moule and W. M. Stevenson.

London.—Savoy Place, W.C.2, 6.30 p.m. I.E.E. London Graduate and Student Section. Address by the President, Sir Willis Jackson. "The Trends of Electrical Progress and their Implications."

Caxton Hall, S.W.1, 6.30 p.m. E.P.E.A. Meter Engineers' Technical Group. "Meter Standardisation," by L. J. Matthews.

Pepys House, 14, Rochester Row, Westminster, S.W.1, 7.30 p.m. Junior Institution of Engineers. Inaugural meeting. Induction of Prof. J. M. Kay as president. Address: "The Engineer's Role in Nuclear Power."

Newport (I. of W.).—S.E.B. Showrooms, 6.30 p.m. I.E.E. Southern Centre. "Television Recording," by J. Redmond.

Stoke-on-Trent.—Technical College, 7 p.m. I.E.E. North Staffordshire Sub-Centre. "Discrimination between H.R.C. Fuses," by E. Jacks.

SATURDAY, 12th DECEMBER

Glasgow.—Ca'dora Restaurant, 122, Union Street. Institution of Plant Engineers, Glasgow Branch. Annual dinner and dance.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Atherstone.—R.D.C. 10th December. Supply, delivery and erection of forty-four 200 W sodium discharge lamps and lanterns, mounted on steel columns, together with control gear. D. C. Smith, surveyor, Council Offices.

Australia.—Director, Stores and Contracts, Postmaster General's Department, Melbourne. 21st January. 160 electron tubes. (E.S.B. 27548/59. Ten/43546.)*

Bath.—City Council. 21st December. Motor tower wagon. (See this issue.)

Belfast.—Northern Ireland Housing Trust. 14th December. Electrical installations in 71 dwellings at Derrycoole Way, Rathcoole, and 343 dwellings and a shop at Rathcoole. Offices of the Trust, 12, Hope Street.

Bilston.—Corporation. 8th January. Group "B" street lighting equipment. (See this issue.)

Birmingham.—Corporation. 4th January. Installation of electrical and other services at fire station. (See this issue.)

Ceylon.—Tender Board, Ministry of Agriculture and Lands, Colombo. 11th December. Two 15 kW diesel generating sets. (E.S.B. 27862/59. Ten/43592.)*

Derbyshire. — South East Derbyshire R.D.C. 14th December. Trunk road lighting equipment. (See this issue.)

East Elloe.—R.D.C. 1st January. Trunk road "A" street lighting equipment. (See this issue.)

India.—West Bengal State Electricity Board, Calcutta. 28th December. Four 132 kV power transformers. (E.S.B. 27753/59. Ten/43570.)*

Punjab State Electricity Board, Patiala. Electricity meters and time switches. (E.S.B. 27231-6/59. Ten/43575-80.)*

Korea.—Bank of Korea, Seoul. 12th January Machine tools, furnaces, telephone exchange equipment, hoists and welders. (E.S.B. 27895/59/I.C.A. Ten/43610.)*

Neath.—R.D.C. 16th December. Trunk road "A" lighting equipment. (See this issue.)

New Zealand. — Wellington Electricity Department. 15th December. Battery operated fork lift truck. (E.S.B. 27683/59. Ten/43539.)*

Norway.—Norwegian Watercourse and Electricity Board, Oslo. 21st December. Two 90 MVA and one 32 MVA transformers. (E.S.B. 27565/59. Ten/43521.)*

Portuguese East Africa.—Lourenço Marques Municipality. 18th December. H.v. meters. (E.S.B. 27941/59. Ten/43608.)*

South Africa.—Johannesburg City Council. 14th December. E.h.v. cubicles and transformers. (E.S.B. 27659/59. Ten/43534.)*

Stores Department, South African Railways, Johannesburg. 18th December. Telephones and telephone switchboards. (E.S.B. 27541/59. Ten/43501.)* 12th February. 12-channel carrier equipment. (E.S.B. 27789/59. Ten/43613.)*

Sudan.—General Electricity and Water Administration, Khartoum. 20th December. Four 500 kVA distribution transformers. (E.S.B. 27600/59. Ten/43527.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Sutton Coldfield.—Corporation. 6th January. Trunk road "A" lighting equipment. (See this issue.)

Syria.—Ministry of Municipal and Rural Affairs, Beirut. Generating sets ranging from 30 to 200 kVA. (E.S.B. 24017/59. Ten/17001.)*

Thailand.—Royal Irrigation Department, Bangkok. 17th December. 230 kV transmission lines. (E.S.B. 27466/59. Ten/43491.)*

ORDERS PLACED

Ashton-under-Lyne.—Corporation. Recommended. Installation of new street lighting at Oldham Road, Wellington Road, Henrietta Street, Broadoak Road, George Street and Warrington Street (£11,182).—Cohen Bros. (Electrical).

Birmingham.—Regional Hospital Board. Recommended. Installation of electrical services at Groundslow Hospital, Stoke-on-Trent (£3,061).—H. Palfreyman. Electrical installation work for Phase VII at Barnsley Hall, Bromsgrove (£9,996).—Lee Beesley & Co. (Birmingham).

Maidenhead.—Corporation. Recommended. Supply and installation of lifts for the municipal buildings (£4,790).—Otis Elevator Co.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Barnsley.—Police headquarters; Lanchester & Lodge, architects, 10, Woburn Square, London, W.C.1.

Bath. — Extensions (£30,000), King Edward's School; Terence W. Snailum, architect, 18, Brock Street.

Birmingham.—Flats and houses (100), Stirling Road; Oscott Estates, Ltd., 658, Chester Road, Sutton Coldfield.

Boston.—Fire station and firemen's houses (£70,500); county architect, Boston, Lincs.

Cockermouth.—New kitchen at Dovenby Hall Hospital for Newcastle Hospital Board (£30,000); John Twiname, Ltd., contractors, Brigham.

Croydon.—Offices, Purley Way; Truett & Steel, Ltd., 71, High Street, Thornton Heath.

Darlington.—Houses (102), Firth Moor estate; E. A. Tornbohm, borough architect.

Dartford.—Flats and maisonnettes (91), Temple Hill estate; borough architect.

Durham.—Secondary modern school at West Pelton; P. L. Browne, Son & Harding, architects, Pearl Buildings, Northumberland Street, Newcastle-upon-Tyne.

Occupation centre at Easington (£21,000); M. D. Lilley & Son, builders, Back Woods Terrace, Murton, Co. Durham.

Houses (116) for R.D.C.; J. F. Willis, housing architect, Byland Lodge, Durham.

Ealing.—Supermarket; Fine Fare, Ltd., 2, Mundells Road, Welwyn Garden City.

Folkestone.—Municipal buildings, Castle Hill Avenue/Trinity Road site (£240,000); Frederick Gibberd, architect, 8, Percy Street, London, W.1.

Gravesend.—Civic centre, Wrotham Road/Windmill Street site; borough engineer, 6, Woodville Terrace.

Haverfordwest.—Additions and extensions to the County Hospital (£133,270); West Wales Hospital Management Committee, Glangwili, Carmarthen.

Heywood.—Maisonnettes and flats in blocks, with lifts, redevelopment of the Angel Meadow site; A. Middleton, borough surveyor, Municipal Buildings, Longford Street.

Ipswich.—New police headquarters as first stage of scheme for development of civic centre; Vine & Vine, architects, 12, Tudor Chambers, Station Road, Wood Green, London, N.22.

Llanelly.—Factory and offices, North Dock, for Crawley Industrial Products, Ltd., Croydon; Wm. Cowlin & Sons, Ltd., Penarth Road, Cardiff.

London.—Television centre and offices, Vauxhall Bridge area; Associated Television, Ltd., A.T.V. House, Great Cumberland Place, W.1.

Office block, Tower Bridge Road, Southwark; McLaughlin & Harvey, Ltd., 24, Highbury Grove, N.5.

Manchester.—Secondary school, Fairfield Road; Mather & Nutter, architects, 3, Chepstow Street.

Works extensions, Glacier Metal Co., Ltd., Talbot Road; Wm. Thorpe & Sons, Ltd., Chester Road.

Middlesbrough.—Maternity and child welfare clinic, Carlow Street; borough engineer.

Houses (300), near Malvern Drive; T. Duncanson & Son, builders, Acklam Road.

Three-storey office block, Bolckow Street, for F. Durham, Ltd.; T. A. Crawford, architect, 80, Borough Road.

Morpeth.—Houses (154), Pegswood; J. R. Miles, R.D.C. surveyor, Dacre Street.

Norwich.—Underground garage, Bethel Street; city architect.

Plymouth.—Mental health centre and central clinic. Seven Trees; city architect, Seymour Road.

Romford.—Four-storey works and offices; Colvern, Ltd., Spring Gardens.

Rotherham.—Works extensions; London & Scandinavian Metal Co., Ltd., Fullerton Road.

Scunthorpe.—Store, High Street and Wells Street; British Home Stores. Ltd., 129, Marylebone Road, London, N.W.1.

Stockport.—Three-storey office block, St. Petersgate; borough architect.

Stockton-on-Tees.—New hospital, Hardwick estate (£5,250,000); P. H. Knighton, chief architect, Newcastle Hospital Board, Benfield Road, Newcastle-on-Tyne.

Sunderland.—Factory, Henry Street East; I. Smith, builder, 2, Canberra Road.

Five-storey block of self-contained flats, Ashbrooke Crescent; Newrick & Blackbell, architects, 58, John Street.

Extensions to Technical College and Training College; H. C. Bishop, borough architect, Grange House, Stockton Road.

Swansea. — Showrooms and offices; Fletchers, Ltd., Nelson Street.

Torquay.—Houses (55); R. M. Dugdale, Kilmorie estate, Ilsham Marine Drive.

Wallsend.—Factory, Stephenson Street; Associated Lead Manufacturers, Ltd., Crescent House, Newcastle-on-Tyne.

Walsall.—School, Sutton Road, for Queen Mary's Grammar School; Robert Matthew & Johnson-Marshall, architects, 24, Park Square East, London, N.W.1.

Worcester. — Extensions, Christopher Whitehead School for Boys; Leathert & Tingay, architects, 49, Welbeck Street, London, W.1.

Worthing.—Extensions, Warren School; Frank Trower, architect, 43, Teville Road.

Five-storey block of flats, Wykeham Road; L. H. Fewster, architect, 5, Liverpool Gardens.

York.—Block of flats, New Earswick; F. Shepherd & Son, Ltd., Blue Bridge Lane.